

## Description of Alternatives

### Introduction and Summary

The Conservancy and the Corps are proposing to restore wetlands at the BMKV site as an addition to the HWRP already authorized for implementation on the adjacent HAAF and SLC parcels. The HWRP project objectives described in chapter 2 could be attained on the BMKV expansion site by restoring wetlands in either of 2 ways: allow the natural process of sedimentation to establish the desired elevation on the expansion restoration site, or actively place dredged materials as fill to establish the desired elevation. Based on these approaches, the Conservancy and the Corps are considering the following restoration alternatives in this document.

- Alternative 1 – Dredged Material Placement with Enlarged Pacheco Pond
- Revised Alternative 2 (Preferred Alternative) – Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond
- Alternative 3 – Natural Sedimentation with Enlarged Pacheco Pond

As required by CEQA and NEPA, the No-Action (or No-Project) Alternative is also evaluated.

This chapter describes the 3 action alternatives selected for analysis in this document. The alternatives and alternative features considered during the design process but dismissed from further consideration are discussed at the end of this chapter. It should be noted that a number of changes were made to Alternative 2 between the Draft and Final SEIR/EIS. These changes were made after consideration by the Corps and the Conservancy of the comments provided by agencies, individuals, and organizations on the Draft SEIR/EIS, and after review of the project goal and objectives. No changes were made to Alternatives 1 or 3 between the Draft and Final SEIR/EIS.

The authorized HWRP is not discussed directly in this chapter, except as it relates to the changes included in the BMKV Expansion. The suite of restoration activities included in the 3 action alternatives includes several proposed changes to the HWRP. These alternatives include the addition of the expansion area and the following potential changes to the authorized HWRP.

- Elimination of a separating levee between the BMKV and SLC sites
- Replacement of the barrier levee between BMKV and HAAF, with an access berm for the NSD line
- Extension of the Bay Trail south and north from the City of Novato levee
- Potential use of diesel off-loading and booster pumps for off-loading dredged material
- Potential alternative alignment of dredged-material pipeline directly from the off-loading facility to the BMKV site (Alternatives 1 and 2)
- Change in location of and increase in high transitional marsh on the SLC parcel
- Repositioning of the tidal breach on SLC to BMKV (Alternatives 2 and 3)
- Addition of new NSD pipeline around east side of expanded Pacheco Pond

Table 3-1 provides an overview of the 3 action alternatives; they, and the No-Action Alternative, are described in greater detail in the text that follows. Table 3-2 summarizes the habitats at maturity expected under each of the 3 alternatives. The process through which the alternatives were developed is presented in the U.S. Army Corps of Engineers General Reevaluation Report (GRR).

**Table 3-1. BMKV Expansion Alternatives Considered in this SEIR/EIS**

	Alternative 1	Revised Alternative 2 (Preferred Alternative)	Alternative 3
<i>Descriptive Name</i>	Dredged Material Placement with Enlarged Pacheco Pond	Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond	Natural Sedimentation with Enlarged Pacheco Pond
<i>Construction Approach</i>	Dredged material placement (13.2 million cubic yards additional for HWRP with expansion)	Dredged material placement (13.8 million cubic yards additional for HWRP with expansion)	Natural sedimentation
<i>Design Elements</i>			
Pacheco Pond Expansion	Yes	Yes	Yes
Outboard Levee Breaches	Novato Creek (BMKV) San Pablo Bay (BMKV) San Pablo Bay (SLC)	Novato Creek (BMKV) San Pablo Bay (BMKV)	San Pablo Bay (BMKV) San Pablo Bay (BMKV)
Habitats	1039 acres tidal wetland 147 acres subtidal and tidal mudflat habitats 40 acres seasonal wetland 10 acres emergent wetland 40 acres open water (pond) 300 acres upland	899 acres tidal wetland 120 acres subtidal and tidal mudflat habitats 277 acres seasonal wetland 12 acres emergent wetland 21 acres open water (pond) 247 acres upland	1,274 acres tidal wetland 197 acres subtidal and tidal mudflat habitats 10 acres emergent wetland 40 acres open water (pond) 55 acres upland

	Alternative 1	Revised Alternative 2 (Preferred Alternative)	Alternative 3
Novato Sanitary District Outfall	Authorized HWRP included relocation of dechlorination plant and retrofit/replacement of existing pipeline. Alt. 1 includes extension of new pipeline around east side of Pacheco Pond, with access road/berm	Authorized HWRP included relocation of dechlorination plant and retrofit/replacement of existing pipeline. Revised Alt. 2 includes access road/berm and extension of new pipeline around east side of expanded Pacheco Pond	Authorized HWRP included relocation of dechlorination plant and retrofit/replacement of existing pipeline. Alt. 3 includes extension of new pipeline around east side of Pacheco Pond, with access road/berm.
New Levees	From enlarged Pacheco Pond to Novato Creek (central crossing levee); along east side of Pacheco Pond	Around east side of expanded Pacheco Pond; along north and south sides of the seasonal wetland; from BMKV/HAAF berm to Novato Creek	Along east side of Pacheco Pond; from enlarged Pacheco Pond to BMK south lagoon and along BMK south lagoon to Novato Creek
Improved Levees	BMK south lagoon	BMK south lagoon and portion of BMKV/HAAF berm; levee west of south lagoon lock	Western portion of BMK south lagoon
Water Management Structures/Pacheco Pond and BMK South Lagoon Connections	Culverts with flapgates at Pacheco Pond; modified BMK lagoon overflow structures; culvert with flapgate in Novato Creek levee	Overflow structure from expanded Pacheco Pond to seasonal wetland; overflow structure from seasonal wetland to tidal wetland area; modified BMK lagoon overflow; and culvert with flapgate to Novato Creek from swale	Culverts with flapgates at Pacheco Pond; pump station near BMK south lagoon lock
Bay Trail, Interpretive Center, and Access Area	<p>Bay Trail along southwest perimeter of HWRP and north from city levee.</p> <p>Bay Trail along west side of Pacheco Pond to Bel Marin Keys Blvd.</p> <p>Spur Option 1A between Pacheco Pond and Hamilton seasonal wetlands, and along central levee to Novato Creek.</p> <p>Interp. Center and access area on property currently owned by the City of Novato west of HWRP seasonal wetland area.</p>	<p>Bay Trail along southwest perimeter of HWRP and north from city levee.</p> <p>Bay Trail between Pacheco Pond and HAAF and between BMKV seasonal wetlands and Pacheco Pond to Bel Marin Keys Blvd around the west side of Headquarters Hill.</p> <p>Interp. Center and access area on Property currently owned by the City of Novato west of seasonal wetland area on HWRP.</p>	<p>Bay Trail along southwest perimeter of HWRP and north from city levee.</p> <p>Bay Trail between Pacheco Pond and HAAF seasonal wetlands, along east side of expanded Pacheco Pond to Bel Marin Keys Blvd.</p> <p>Spur Option 3A along new levee south of BMK south lagoon levee to Novato Creek.</p> <p>Interp. Center and access area on northwest side of BMKV.</p>

	Alternative 1	Revised Alternative 2 (Preferred Alternative)	Alternative 3
BMKV Upland Habitat Buffer	Upland habitat buffer area in swale south of BMK south lagoon.	Upland buffer area in swale south of BMK south lagoon.	Upland buffer only in area south of western portion of BMK south lagoon.
PG&E Tower Footings	Jacketed to prevent erosion/corrosion	Same as Alternative 1	Same as Alternative 1

**Table 3-2.** Estimated Postrestoration Habitat Acreages at BMKV Expansion Site

Alternative	Subtidal	Tidal Mudflat	Low Marsh	Tidal Marsh	High Transitional Marsh	Seasonal Wetland	Freshwater Emergent Wetland	Open Water	Upland	Total
1	90	57	30	849	160	40	10	40	300	1,576
2	72	48	28	792	79	277	12	21	247	1,576
3	130	67	40	1,204	30	0	10	40	55	1,576

Notes:

Upland habitat	=	non-inundated areas; dominated by grassland
Open water habitat	=	areas within expanded Pacheco Pond
Freshwater emergent wetland	=	fringing emergent marsh along expanded Pacheco Pond
Seasonal wetland	=	seasonally-inundated non-tidal areas dominated by hydrophytic vegetation
High transitional marsh	=	areas east of outboard levee inundated by plus tides; above mean higher-high water
Tidal marsh	=	mean high water to mean higher-high water.
Low marsh habitat	=	mean sea level–mean high water
Tidal mudflat habitat	=	mean lower low water–mean sea level
Subtidal	=	aquatic habitat below mean lower low water

The North Marin Water District (NMWD) is considering a plan to extend a water line from Ammo Hill to Bel Marin Keys Boulevard (see figure 1-2 in chapter 1). It is conceivable that the water line could be built during construction of the proposed BMKV expansion. The likely location of the line would be along the existing or new levees constructed along the western side of the BMKV parcel. The NMWD would need to obtain an easement from the Conservancy. Simultaneous construction of the water line and the restoration project is feasible within the designs proposed. Neither constructing the water line nor granting the easement is included as part of the proposed BMKV expansion. However, the design alternatives do not preclude granting the easement or constructing the water line. The Corps and Conservancy will work with the NMWD to examine how the water line planning can be incorporated into the final design of the BMKV expansion. If the proposed water line extension is later determined to result in any additional impacts beyond those analyzed in this document for earthworks construction and habitat restoration, a supplemental environmental compliance document may be necessary. Any additional environmental compliance documentation would be the responsibility of NMWD and not the Corps or Conservancy.

# Alternatives Under Consideration

## No-Action Alternative

Under the No-Action Alternative, no wetland restoration would take place at the BMKV site and no Bay Trail would be constructed through the BMKV property nor extended further along the perimeter HWRP. Under this alternative, it is assumed that the Corps, Conservancy, or successors in interest would

- allow agriculture to continue on the BMKV site;
- continue to operate and maintain drainage and pumping facilities on the site;
- maintain levees; and
- implement the HWRP, including construction of a barrier levee along the boundary between the HAAF/SLC restoration sites and the BMKV parcel.

## Alternative 1 – Dredged Material Placement with Enlarged Pacheco Pond

### Overview of Alternative 1

Figures 3-1 and 3-2 show Alternative 1 at maturity. Under Alternative 1, tidal (tidal marsh, tidal flat, and subtidal) and nontidal (high-transitional marsh, seasonal wetland, perennial wetland, perennial open water, and upland) habitat types would be restored to the expansion site. Imported dredged material (determined to be suitable wetland cover material based on Dredged Material Management Office [DMMO] requirements) would be used to create upland and seasonal wetland habitats and to create surface elevations suitable to accelerate the establishment of tidal marsh vegetation. Final marsh plain elevations would develop over time through the natural deposition of sediments from San Pablo Bay, supporting the establishment of tidal marsh vegetation. The acreage of each habitat type restored under Alternative 1 is shown in table 3-3 below.

**Table 3-3.** Summary of Alternative 1: Dredged Material Placement with Enlarged Pacheco Pond

Habitats	1,039 acres tidal wetland 147 acres subtidal and tidal mudflat habitats 40 acres seasonal wetland 40 acres open water (expanded Pacheco Pond) 10 acres emergent marsh 300 acres upland
Outboard Levee Breaches	Novato Creek (BMKV); San Pablo Bay (BMKV); San Pablo Bay (SLC)
Novato Sanitary District Outfall	New pipeline along east side of Pacheco Pond, with access road/berm (4–6' NGVD <sup>1</sup> ). Authorized HWRP already includes replacement/retrofit of existing pipeline and relocation of dechlorination plant.
New Levees	From enlarged Pacheco Pond to Novato Creek (central levee 8–12' NGVD). Along east side of expanded Pacheco Pond.
Improved Levees	BMK south lagoon (6–10' NGVD)
Water Management Structures/Pacheco Pond and BMK south lagoon connections	Culverts with flapgates at Pacheco Pond. Culvert with flapgate in Novato Creek levee to drain swale. Modified BMK lagoon overflow structures
Bay Trail, Interpretive Center, and access area	Along southwest perimeter of HWRP and north from city levee and along west side of Pacheco Pond to Bel Marin Keys Blvd. Spur Option 1A between Pacheco Pond and HAAF seasonal wetlands, and along central levee to Novato Creek. Interpretive center and access area northwest of HWRP.

**Note:**

NGVD stands for National Geodetic Vertical Datum of 1929 which is a fixed reference adopted as a standard geodetic datum for elevations determined by leveling. It was formerly called "Sea Level Datum of 1929" or "mean sea level". Although the datum was derived from the mean sea level at 26 tide stations, it does not necessarily represent local mean sea level at any particular place.

### Tidal Wetland Design

In the eastern portion of the site, 3 tidally influenced sub-basins, each approximately 400 acres in size, would be created as cells to facilitate the placement of dredged material and the establishment of tidal marsh vegetation. Dredged material would be placed in each sub-basin to create surface elevations ranging from approximately 2 feet NGVD (1 foot below mean high water [MHW]) along the basin perimeter to approximately 0 feet NGVD near the outboard levee. Additional dredged material would be placed in the southeast corner of the site to create surface elevations (approximately 3.5 feet NGVD) suitable for the establishment of high transitional marsh vegetation. After fill placement activities have been completed, the outboard levees would be breached in 3 locations to restore the hydrologic connections to San Pablo Bay and Novato Creek. The levee along Novato Creek would be lowered to facilitate overflow onto the expansion site from Novato Creek during peak storm events.

The levee along San Pablo Bay would also be lowered to create topographic diversity and facilitate the establishment of mid-high marsh vegetation. Several high points along the levee will be left as high-tide refugia. Final marsh plain elevations would be established via natural deposition of fine-grained sediments from San Pablo Bay and Novato Creek. Final surface elevations in the 3 marsh sub-basins would range from approximately 0.5 to 3.5 feet NGVD.

## Levees and BMK Lagoon Drainage

A levee with an initial top elevation of 12 feet NGVD would be constructed across the northwestern portion of the expansion site to separate the nontidal and tidal habitats. This initial elevation includes a 4-foot settlement allowance, which would result in a final elevation of 8 feet NGVD. The outboard (east) side of the levee would be constructed with a gentle side slope that would transition from upland to high- to mid-marsh habitat types. The inboard (west) side of the levee would be constructed with a gradual slope from a base elevation of 1 foot NGVD to a crest of 12 feet NGVD. The existing levee along the BMK south lagoon would be improved with an initial top elevation of 10 feet NGVD, which includes a 4-foot settlement allowance, resulting in a final top elevation of 6 feet NGVD (see figure 3-12 at the end of this section). This alternative would also include an overflow structure or structures would be installed to convey overflow from the lagoon into the swale area. Overflow from the lagoon and seasonal precipitation would support the establishment of seasonal wetland habitat in the swale located between the 2 levees. Plant species composition in this area would vary according to salinity, inundation frequency, and duration; however vegetation would likely consist of emergent wetland vegetation (e.g., bulrushes, cattails, rushes), and grasses and forbs. Conceptual levee designs are shown in figure 3-12 after page 3-38 in this section.

## Nontidal Habitat Design and Pacheco Pond Connection

In the northwestern portion of the expansion site, approximately 50 acres of perennial open water and wetland habitat would be created by enlarging an existing pond (Pacheco Pond). The levee that now separates the expansion site from Pacheco Pond would be breached in several locations to provide a larger contiguous area of open-water habitat. The bottom elevation of Pacheco Pond would remain at the existing elevation of -3 feet, and the pond would continued to be managed to maintain a surface water level of approximately 1.5 feet following enlargement of the pond. Sections of the levee would be left in place to provide roosting and nesting habitat for shorebirds. A bench would be constructed along the inboard perimeter of the new pond levee to promote the establishment of freshwater emergent vegetation. A culvert structure would be installed in the new pond levee to allow the release of overflow waters from the pond into the tidal marsh basin. A significant portion of existing Pacheco Pond storm runoff may be directed through the tidal marsh basin.

The salinity of the water in the channel flowing through the tidal marsh basin would vary, depending on the outflow from Pacheco Pond and the extent of tidal inundation. As water is released from Pacheco Pond following large wet season storm events, salinities within the channel would range from freshwater values near the overflow to brackish and marine levels as water flows into the marsh basin. During extreme high tides, the channel would be inundated by tidal flow and salinity would increase to near marine levels. The freshwater pond environment would not be affected during these periods because the flapgate would prevent tidal flows from entering the pond. During the summer months and dry times of the year, the salinity of water in the channel would be comparable to that in San Pablo Bay.

Under this alternative, Pacheco Pond would have 2 outlets: the existing outlet to Novato Creek via the outlet channel, and a new outlet to the tidal marsh restoration area. DFG and the Marin County Flood Control and Water Conservation District (MCFCWCD) have an existing agreement to manage Pacheco Pond for the dual purposes of flood control and wildlife. The BMKV expansion would include development of a new water management plan for Pacheco Pond, which the Conservancy or successors, DFG, and MCFCWCD would jointly implement to continue manage flood control and wildlife.

## **Novato Sanitary District Outfall**

The authorized HWRP already includes the relocation of the NSD dechlorination plant and the relocation/retrofit of the existing NSD pipeline. Alternative 1 would include the installation of a new sanitary outfall pipeline along the eastern side of the expanded Pacheco Pond and construction of an access road/berm. The existing pipeline would be replaced or retrofitted as part of the HWRP because of potential differential settling and leakage (U.S. Army Corps of Engineers 2001b). If a new pipeline is placed, it would be installed slightly below the grade of the existing pipeline; the existing pipeline would be abandoned in place to provide protection from potential scour associated with the formation of tidal channels. The NSD pipeline would be located along a new alignment around the east side of the expanded Pacheco Pond. The pipeline would be installed at a depth below the invert of the outlet structure from Pacheco Pond to the tidal wetland restoration area.

NSD would access the pipeline by existing or new levees leading to an improved berm along the existing alignment (at the property line separating BMKV from HAAF). The top of the berm would be built to between 4 and 6 feet NGVD. If the top of the berm were built to 4 feet NGVD, it would be 0.5 foot above mean higher high water (MHHW), which is suitable for high marsh community establishment but not for upland conditions. At this elevation, equipment could only use the berm for emergency situations or scheduled or permitted repair of leaks in the pipeline; the access road would not be an “all-weather” road.

If the top of the berm were built to approximately 6 feet NGVD, it would be 2.5 feet above MHHW, which is suitable for upland conditions. The berm could provide access for regular maintenance or inspections, in addition to emergency situations and scheduled and permitted repair of leaks in the pipeline.

The purpose of analyzing 2 elevations for the access road is to evaluate the tradeoffs between creating upland corridors for predators (such as red fox) and differing levels of access for NSD.

As part of the authorized HWRP, the existing NSD dechlorination plant would be relocated to NSD's Ignacio Treatment Plant, Novato Treatment Plant, or another suitable location. Relocating the dechlorination plant would avoid the need to provide an alternative power supply to the plant and would make the plant more easily accessible to NSD personnel for operation and maintenance.

### **Bay Trail, Interpretive Center, and Access Area**

Alternative 1 would also include construction of public access facilities. The existing HWRP routes a Bay Trail along the City of Novato levee, which has an existing trail, along the west side of the HWRP restoration area.

Under this alternative, the Bay Trail would be extended southward from the terminus of the existing trail at the pump station near the Hamilton baseball field and then proceed along the southwestern perimeter of the HWRP to a point approximately 700 feet from the existing outboard marsh. The trail would follow either the existing road or a new levee constructed as part of the HWRP, until meeting the existing perimeter levee. The trail would then turn northward, and then eastward to follow the improved levee that would be built in the location of the existing perimeter levee (routing of the Bay Trail at Hamilton is shown on figure 3-1 and on figure 4-10 in the *Biological Resources* section in chapter 4). The City of Novato has adopted a plan to connect this portion of the trail to an interim trail, which would traverse the Las Gallinas Valley Sanitary District property to the south, and then connect to the Bay Trail further south. This is not part of the expansion of the HWRP.

Also under this alternative, the Bay Trail would be extended northward along the west side of Pacheco Pond to Bel Marin Keys Boulevard. The trail would proceed north from the City of Novato levee along the western edge of the HWRP restoration area, proceed around the base of Ammo Hill on existing dirt roads on City of Novato-owned land, cross the confluence of Pacheco and San Jose Creeks, follow the existing MCFCWCD service road, and then connect to Bel Marin Keys Boulevard by boardwalk and bridge (approximate length 200 feet). Crossing the confluence would require the installation of several additional bridges (each approximately 75 feet long) and a number of sections of boardwalk. The total approximate length of boardwalk sections would be about 1,800 feet.

A review of parcel maps for this area indicates that the trail would cross federal land (on HAAF), city-owned land (northwest of HAAF near Ammo Hill), and MCFCWCD-owned land. Under this alternative, the Corps and Conservancy would construct the trail on state and federal land, the Conservancy would construct the trail on MCFCWCD land (if MCFCWCD granted an easement), and the City of Novato would construct the portion on its land. The land for this proposed trail segment around the west side of Pacheco Pond is not owned by the Conservancy. Coordination and agreement with MCFCWCD would be required to acquire easements and/or additional property to facilitate construction.

Spur Option 1A would include a spur trail eastward from the Bay Trail to Novato Creek. It would cross the levee between Pacheco Pond and the HWRP, and proceed along the proposed levee that separates the upland buffer/swale area from the restored tidal wetlands. This spur would terminate at Novato Creek, where a gate would be installed to prevent trail users from entering the BMK residential area.

The final site-specific design of the new Bay Trail has not been completed, but it may include some of the following components (City of Novato and the California State Coastal Conservancy 2001).

- Locating the trail on the mid-slope of levees to minimize visual disruption effecting sensitive wildlife, where feasible.
- Designing the trail to ensure a buffer between the trail and sensitive habitat areas, and providing overlooks or vista points offering views of buffer zones and adjacent habitat areas
- Installing barriers (such as fencing) or buffers (such as vegetation), as appropriate, to prevent intrusion by humans and pets
- Grading a topographic separation or constructing trail segments at low elevations relative to adjacent residential areas to provide privacy
- Installing a gated entry to exclude motorized vehicles

The Conservancy, Corps, or successors in interest would develop the final design for any proposed Bay Trail routes or spur trail options in coordination with BCDC, DFG, USFWS, the County of Marin, the City of Novato, and the Bay Trail project. In addition, the Conservancy, Corps, or successors in interest would develop a trail management plan in cooperation with these same agencies. This management plan would take into account the results of the latest research in the San Francisco Bay Area on wildlife/access interactions. The plan would evaluate and/or incorporate the following elements.

- Restriction of motorized vehicle access
- Restriction of dog access
- Restriction of fishing and/or wildlife feeding
- Seasonal/periodic closures during sensitive wildlife seasons

- Timing of trail maintenance
- Annual monitoring of access/wildlife interactions

Additional public access facilities proposed under Alternative 1 include an interpretive center located southeast of Ammo Hill and west of the HAAF seasonal wetland restoration area. This property is currently owned by the City of Novato and is referred to as the “bulge” parcel. The interpretive center would be located along the road designated as the HWRP wetland restoration access road, and is conceptually envisioned as an approximately 1000-square-foot building housing exhibits that provide information about the wetland restoration projects and the local flora and fauna. The interpretive center would serve as a trailhead and would be connected to the proposed Bay Trail routes by new trails routed along existing dirt roads.

Since the interpretive center will be placed on lands that are not required for federal project purposes, and since Corps policy greatly limits expenditures for educational facilities, the interpretive center will not be a project feature to be paid for or constructed by the federal government. The land required for the interpretive center is outside the Federal project. However, the project design has accommodated the interpretive center construction, which would be carried out by others. The federal government will be able to share the expenses of some recreation features including a parking area (approximately 10-20 spaces), restrooms, and information kiosks. These features would take up about 2 acres and are referred to collectively in this document as the “access area.” Only land required for these approved features can be cost-shared by the Federal government.

## Habitat Benefits

Alternative 1 would provide 1,039 acres of tidal wetland; 147 acres of other tidal habitats; 40 acres of seasonal wetland; 40 acres of open water (expanded Pacheco Pond); 10 acres of emergent marsh, and 300 acres of upland. Restoration of the proposed habitats would benefit numerous special-status and common wildlife species. The restoration of tidal salt marsh and associated aquatic habitats is expected to contribute to the recovery of populations of several wetland-dependent special-status species by substantially increasing the amount of viable habitat available for these species in San Pablo Bay.

**Subtidal Aquatic Habitat.** Many species of waterfowl and diving birds use this habitat for feeding on benthic organisms which can be found in the sandy, muddy bottom. Bay fish species also utilize this area.

**Intertidal Aquatic Habitat.** Intertidal aquatic habitat comprises intertidal mud flats and coastal salt marsh. Mudflats are highly productive and support large populations of benthic organisms, including aquatic worms, crustaceans, and mollusks and are important elements of the estuarine food web. Mudflats also provide important foraging areas for migrant and wintering shorebirds, wading

birds, and gulls. Benthic organisms use this habitat in the same way they use intertidal mudflats.

**Coastal Salt Marsh.** Tidal coastal salt marsh provides ideal foraging conditions for rails, egrets, herons, waterfowl, and shorebirds, among others. The salt marsh community provides nutrients and organic matter to the mudflats and open water of the Bay. These, in turn, are important habitats for a variety of waterfowl, shorebirds, and other water birds. Coastal salt marsh is also used as direct cover and sources of food by rearing juvenile and adult fish, such as longfin smelt, Chinook salmon, and steelhead. Sensitive species like the California clapper rail, salt marsh harvest mouse, salt marsh common yellowthroat, and San Pablo song sparrow are dependent on coastal salt marsh.

**Seasonal and Emergent Wetlands.** Seasonal and emergent wetlands potentially provide high-tide refugia for California clapper rail, California black rail, and other species that use tidal coastal salt marshes. They provide seasonal foraging and resting habitat for migratory shorebirds, waterfowl, and other water birds. They also provide foraging habitat for raptors, herons, egrets, blackbirds, raccoons, striped skunks, and aquatic garter snakes. Emergent marsh habitat also provides nesting, foraging, and escape cover for various songbirds and wading birds.

**Open Water.** Water birds expected to use open water include waterfowl, grebes, loons, cormorants, rails, pelicans, coots, moorhens, terns, gulls, herons, egrets, shorebirds, and blackbirds. The open water (i.e., Pacheco Pond) would also be expected to support smelt and bullhead, among other fish species.

**Upland/Grassland.** Annual grassland provides habitat for various wildlife species. Representative wildlife species that would be expected to use grasslands at the expansion site are the turkey vulture, white-tailed kite, northern harrier, red-tailed hawk, golden eagle, American kestrel, short-eared owl, savannah sparrow, western meadowlark, and Brewer's blackbird. In addition, these upland areas can also be used as high-tide refugia by birds utilizing tidally-inundated areas.

## Construction Approach, Alternative 1

The following provides a detailed description of construction activities that would be implemented under Alternative 1 to restore salt marsh, perennial open water and wetlands, seasonal wetlands, and uplands at the BMKV site. Construction activities to restore habitats on the site would be implemented in 3 phases.

- Phase 1 – Site Preparation
- Phase 2 – Dredged Material Placement
- Phase 3 – Earthwork, Revegetation, and Tidal Connection

*Site preparation* includes the construction activities necessary to prepare the site for dredged material placement (e.g., removal of existing infrastructure, construction of levees) and initial excavation of the primary slough channel. *Dredged material placement* consists of pumping and placing dredged material, decanting water (resulting from the settling of slurry material), and, if required, treating the decanted water prior to discharge into San Pablo Bay. *Earthwork, revegetation, and tidal connection* include activities such as seeding/planting nontidal areas, and final earthwork activities (e.g., levee grading, breaching). Figure 3-3 illustrates the construction effort for Alternative 1.

## Phase 1 – Site Preparation

### Create Staging Area and Site Access

A staging area approximately 20 to 30 acres in size would be created in the southern portion of the site, midway between Pacheco Pond and the SLC parcel, to provide storage for salvaged soils and sediments and for equipment, fuel, and supplies. Areas used for staging and site access would be cleared and graded. Heavy equipment such as bulldozers, scrapers, and graders would be used to construct the staging area and any required site-access improvements.

### Modify and Remove Existing Infrastructure

The expansion site supports a variety of site-specific (farm buildings, drainage pumps, ditches, pipelines, and levees) and regional (electric transmission line towers, sanitary sewer outfall line) infrastructure that would be modified or removed prior to the onset of restoration activities. The electric transmission line towers located onsite would be jacketed with concrete to minimize corrosion associated with tidal inundation. Utility service would not be interrupted during this activity. A new outfall pipeline would be installed along the levee (the existing alignment) that separates the expansion site from the adjacent HAAF parcel. The new pipeline would be installed below the grade of the existing pipeline; the existing pipeline would be abandoned in place to provide protection from potential scour associated with the formation of tidal channels. Equipment, such as bulldozers, excavators, loaders, cranes, cement mixers, and dump trucks, would be used to modify and/or demolish existing infrastructure.

### Excavate and Salvage Topsoil

Dredged material would be placed in areas designated for nontidal habitat under this alternative to help establish target elevations. The final foot of cover material for the nontidal habitat areas would be either dredged material or salvaged onsite topsoil. Use of dredged material would be as described below under *Dredged Material Placement*. Using dredged material as cover would result in saline soils that could inhibit nontidal vegetation establishment until freshwater flows and/or precipitation over time resulted in an environment more favorable to nontidal vegetation. Use of onsite topsoil as cover would result in soils that are initially more favorable to nontidal vegetation, although existing onsite topsoil could contain seed from non-native species. Both approaches are considered in the conceptual design.

In addition to potentially being used as final seasonal wetland cover, salvaged onsite soil would also be used for construction of earthworks such as levees and berms.

Approximately the upper 1 to 2 feet of existing site soils and sediments would be excavated from designated areas for later application in nontidal habitat areas during Phase 3 or use in earthworks. The upper 3 inches of the onsite material would be removed and stockpiled separately for use as base material in earthworks to limit the germination of existing non-native seed stock and the proliferation of non-target plant species. The lower portion of onsite material would be salvaged and stockpiled separately within the staging area for use as nontidal habitat cover and/or in earthworks. Materials would be excavated using excavators, scrapers, and bulldozers, and transported to the stockpile area using dump trucks.

### **Construct Levees**

A variety of levees would be constructed on the expansion site to facilitate creation of habitat features and placement of dredged material, and to provide appropriate levels of flood protection for adjacent landowners. Design parameters and functions would vary by levee type. However, site preparation techniques and construction activities would typically be consistent for all levee types.

Prior to levee construction, the footprint of the levee would be cleared, and the ground surface would be excavated to a suitable depth and compacted. Excavated material would be stockpiled onsite for future reapplication (see *Excavate and Salvage Topsoil* above). The levees would be constructed using suitable excavated material from the site or imported fill material. Geotextile materials may be used to enhance the stability of the levee foundations. Levee construction would involve a variety of heavy equipment, such as excavators, loaders, backhoes, track-mounted cranes, and bulldozers. Equipment such as dump trucks, bottom-dump trucks, or scrapers would be used to transport imported or borrow material to the levee construction areas.

### ***New and Improved Levees/Berms***

Approximately 37,500 linear feet of existing levees/berms along the perimeter of the site would be improved to facilitate the placement of dredged material. Additional levees, approximately 13,000 feet in length, would be constructed across the western portion of the site to create habitat features (e.g., open-water and freshwater wetland habitats) and to provide appropriate levels of flood protection for adjacent landowners. Levees would typically have a top width of 12–16 feet and side slopes appropriate for site conditions (at least 3:1 [horizontal:vertical] side slopes). The levees would be used as access roads and would be engineered to support vehicle loads and to prevent excessive seepage. Turnaround areas would generally be constructed every 2,000 feet. The levees would also be used to support the delivery pipeline for dredged materials. Equipment used for construction and/or improvement of perimeter levees may include bulldozers, excavators, scrapers, and graders, as well as dump trucks for delivery of suitable fill and/or road-base materials.

The berm along the southern perimeter of the site (between BMKV and HAAF) would be constructed to between 4 and 6 feet NGVD under this alternative.

### ***Phase Levees***

Prior to transporting and placing dredged material, a series of internal levees (approximately 30,400 linear feet) would be constructed within the expansion restoration site to facilitate phasing (i.e. construction of smaller portions of the site in sequence rather than the entire site at once). The site would be divided into 3 subunits based on drainage basin size and configuration. Phase levees would typically have a top width of between 12 feet and 16 feet and side slopes appropriate for site conditions (at least 3:1). Levee elevations would vary, depending on existing topography and the desired final marsh plain elevation. The levees could be used as access roads and would be engineered to support vehicle loads. Turnaround areas would generally be constructed every 2,000 feet. The levees could also be used to support the delivery pipeline for dredged materials.

### ***Interior Peninsulas***

A series of berms and interior peninsulas (approximately 15,800 linear feet) would be constructed within the marsh basins to: facilitate placement of dredged material, maximize dredged material residence time, and promote sediment settling; reduce resuspension of sediments due to wind/wave mixing; and decrease wave fetch, reducing wave erosion of perimeter and containment levees. Berms would be constructed along basin divides based on the proposed drainage channel subdivide networks. The berms would be constructed with gently sloping side slopes and a maximum elevation between MHW and MHHW. The berms and interior peninsulas would be constructed to gradually erode over time to create topographic diversity within the marsh basins and promote development of mid-and high-marsh vegetation.

### ***Construct Water Quality Detention Ponds***

The expansion site would be subdivided into marsh drainage basins approximately 400 acres in size (corresponding to the phase units described previously). A pilot channel approximately 150 feet wide and 800 feet long would be excavated in each marsh basin. Excavated materials would be used to construct berms around the pilot channel to form water quality detention ponds. Each pilot channel would function as a primary drainage route for water decanted from the marsh basin. Decanted water would flow into the water quality detention pond and would be discharged through gravity flow or by pumping from the pilot channel into San Pablo Bay or Novato Creek. Depending on water quality parameters, decanted water would either be discharged directly into San Pablo Bay or Novato Creek, or treated prior to discharge. Traditional earthwork equipment, including excavators, backhoes, bulldozers, and scrapers would be used to construct the detention ponds. If the site is too wet to support traditional equipment, equipment such as track-mounted excavators or draglines might be used instead.

## **Construct Dredged Material–Related Infrastructure**

Construction of the off-loader facility and primary pipeline was studied in the 1998 EIR/EIS for the HWRP. However, the potential use of pile-driving and diesel pumps is analyzed in this document because it was not studied in the prior EIR/EIS. Also, placement of the secondary distribution pipelines on BMKV is studied in this document because it was not studied in the prior EIR/EIS.

### ***Material Off-loading Facility***

Transport scows and hopper dredges would be used to move material from areas where dredging is taking place to a designated off-loading facility in San Pablo Bay. The off-loading facility would be located approximately 30,000 feet from the expansion restoration site at approximately the –24 to –28 foot mean lower low water (MLLW) contour to enable large scows and transports (5,000 cubic yard capacity) to moor and off-load. Dredged material would be removed from the barges at the off-loading facility and pumped to the expansion site. Water would be added to the dredged material via an auxiliary feedwater pump to create a slurry consisting of approximately 20% dredged material and 80% water by volume. The pump would be powered by diesel fuel or electricity. If required, electrical power would be provided by a submerged high voltage power cable from the expansion site or from other existing power lines in adjacent areas. The off-loader platform may be either pile-mounted or floating. If pile-mounted, approximately 24 piles (each 36 inches in diameter) would be needed for the off-loader platforms.

### ***Primary Delivery Pipeline***

An 18-inch or larger pipeline would be used to transport slurry from the off-loading facilities to the expansion site. The pipeline may be submerged and anchored to reduce hazards to navigation and vulnerability to wind and wave action. As indicated in figure 3-4, the final routing of the pipeline would be determined in final design, but it might be routed to the HAAF or BMKV site.

### ***Booster Pump Facility***

One or more booster pump facilities consisting of a platform and booster pumps would be installed in designated locations along the primary delivery pipeline to enhance pumping capacity and facilitate delivery of the dredged material slurry to the expansion restoration site. Depending on specific location and other factors such as wind and wave action, the platforms may be either pile-mounted or floating. A booster pump might also be located along the shore segment of the pipeline. The booster pumps would be powered by diesel or electricity. If required, electrical power would be provided by a submerged high voltage power cable from the expansion site or from other existing power lines in adjacent areas. If pile-mounted, approximately 4 to 8 piles (each 36 inches in diameter) would be needed for the booster platform.

### ***Secondary Distribution Pipelines***

A series of secondary pipelines would be used to convey the slurry from the primary pipeline to selected marsh basins. The secondary distribution pipelines would be placed on the perimeter and phase levees. If necessary, additional mobile pumps would be placed at locations along the secondary distribution pipeline to keep the slurry moving through the pipeline. Discharge points would be provided at regular intervals along the secondary pipelines to ensure even distribution of the slurry within the marsh basins.

## **Phase 2 – Dredged Material Placement**

### **Pump Dredged Material**

The dredged material slurry would be pumped from the off-loading facility through the primary and secondary pipelines and delivered to the marsh basins. Over a relatively short time, the sediment in the slurry would separate and settle to the bottom of the marsh basins. Sand and other coarser material would settle first, followed by the finer-grained silts and clays. Because the coarser materials may tend to mound near the slurry inlet, it may be necessary to reposition the inlet occasionally to ensure even distribution of material.

Approximately 13,200,000 cubic yards of additional dredged material (beyond that already included in the authorized HWRP) would be imported to the expansion site for creation of tidal and nontidal habitats. Dredged material may originate from many sources, including the Port of Oakland 50-foot Deepening Project, Corps of Engineers operations and maintenance dredging program, and other non-federal dredging projects. Only material determined to be suitable wetland cover material by the DMMO would be accepted for use at the expansion site. Through a review of potential dredging, the Corps has estimated that adequate dredged material supplies are available for the HWRP/BMKV expansion project. The Corps and Conservancy are willing to accept dredged materials from the Bel Marin Keys Community Services District (BMK CSD) (from lagoon and Novato Creek dredging events) and from the MCFCWCD (from Novato Creek dredging events) if they are determined to be suitable wetland cover material by the DMMO, their reuse is cost-effective to the project and the timing and other parameters of the dredged material's availability are consistent with the project implementation process.

Placement and draining operations would continue until the desired surface elevations (0 feet to 2 feet NGVD) have been reached in each marsh basin. Final elevations in the tidal marsh basins would be established by natural sedimentation and erosion processes once tidal action has been restored to the expansion restoration sites. Soils and sediments salvaged onsite would be used to create final surface elevations in areas of nontidal habitat.

### **Treat Decanted Water and Discharge**

As solids settle from the slurry, clarified water would be decanted and discharged to a water quality detention pond at the mouths of the main channels (location to be determined). Before it is discharged to San Pablo Bay, the water would be tested to ensure that it meets or exceeds the BMKV expansion waste discharge requirements. Depending on the results of the tests, decant water may be treated before discharge, or it may be discharged directly into the Bay.

## **Phase 3 – Earthwork, Revegetation, and Tidal Connection**

### **Grade Phase Levees to Finished Grade**

After dredged materials are placed and dewatered, the phase levees would be graded down to an elevation between MHW and MHHW to create topographic diversity, promote establishment of mid- to high-marsh vegetation, and provide refugia for wildlife species. Portions of the existing outboard levee would be left in place to provide high-tide refugia for marsh species. Grading would involve a variety of heavy equipment, such as excavators, backhoes, track-mounted cranes, bulldozers, and haul trucks.

### **Create Habitats through Use of Salvaged Topsoil**

If salvaged topsoil were used for final cover in nontidal habitat areas, site soils and sediments excavated and salvaged during Phase 1 would be placed in the seasonal wetland and upland habitat areas to facilitate the establishment of native vegetation and prevent the development of acid sulfate conditions. Haul trucks, bulldozers, and compactors would be used to transport and place salvaged materials. As discussed above, dredged material may also be used for habitat creation.

### **Seed/Plant Nontidal Habitat Areas**

As necessary, areas of nontidal habitat would be seeded and/or planted with native vegetation.

### **Install Water Management Structures**

During the final phases of construction, a number of flow control structures (e.g., culverts, weirs) would be installed to facilitate future water management activities. An overflow structure (roughly equivalent capacity to six 4-foot by 4-foot box culverts) would be installed in the new Pacheco Pond levee to allow the release of overflow waters from the pond into the tidal marsh basin. The existing overflow from the BMK lagoon in the northern portion of the site would be modified by adding culverts to facilitate overflow into the constructed seasonal wetland swale during storm events. An additional culvert with a flapgate, approximately 48 inches in width, would be installed in the existing Novato Creek levee to allow the swale to drain into Novato Creek.

## **Excavate Connecting Channel and Breach Levee**

Upon completion of dredged material placement activities, the water quality detention basins would be filled to the final placement grade, pilot channels approximately 150 feet wide and 800 feet long would be excavated in each marsh basin, and the perimeter levee would be breached to restore the tidal connection with San Pablo Bay and Novato Creek. Upon completion of dredged material placement activities, the perimeter levees would be breached and pilot channels would be excavated in designated locations to restore tidal connections to San Pablo Bay and Novato Creek. On either side of the levee breaches, the outboard levee would be lowered to an elevation between MHW and MHHW to create topographic diversity, promote establishment of mid- to high-marsh vegetation, and provide refugia for wildlife species. Additionally, the levee along Novato Creek would be lowered to approximately MHW to facilitate overflow onto the expansion site from Novato Creek during peak storm events. Levee breaching and grading and channel excavation would involve a variety of heavy equipment, including track-, mat-, or pad-mounted excavators; backhoes; bulldozers; dump trucks; draglines; and/or a suction dredge.

## **Construction Timing, Alternative 1**

Under Alternative 1, site construction is expected to last approximately 13 to 15 years; anticipated durations of the 3 construction phases are as follows.

- Site preparation – 2 years
- Dredged material placement – 10 years (includes placement and dewatering and consolidation for HAAF, SLC, and BMKV)
- Earthwork and tidal connection – 1 year

As noted above, this alternative includes three tidal sub-basins and other habitat areas such as the swale area, separated by either temporary or permanent levees. Restoration activities could be conducted based on sub-basin boundaries and/or habitat types, to allow for sequential creation of habitat. Fill could be placed either sequentially or concurrently in different basins and/or habitat types. As one example of the sequential approach, dredged material placement in one of the tidal cells would take about 4 years. Upon completion of dredged material placement, breaching of this tidal cell could take place prior to filling of the other cells. For the first tidal cell, construction time to tidal breach could be around 7 years in a sequential approach.

The Alternative 1 schedule is dependent in part upon completion of the FUDS remedial activities on the SLC parcel on the authorized HWRP site. Because there is no separating levee between BMKV and the SLC parcel in this alternative, breaching into the southern cell could not be completed until the FUDS remedial activities have been completed and the placement of additional dredged material to create high tidal marsh has been completed.

## **Revised Alternative 2 – Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond**

### **Revised Alternative 2 – Preferred Alternative**

During the review of the Draft SEIR/EIS, the Corps and Conservancy made several design changes to Alternative 2 as a result of public and agency comment on the document, design requirements, and environmental factors. Subsequently, the Corps and Conservancy selected the Revised Alternative 2 as the preferred alternative. The following are the revisions made to the design of Alternative 2, and a description of these changes follows below:

- Expansion of the swale south of the BMK south lagoon from 230 acres to 388 acres (including 247 acres of upland and 141 acres of seasonal wetland);
- Addition of a 21-acre expansion of Pacheco Pond with an adjacent 12-acre emergent marsh (33-acre expansion);
- Construction elevation of south lagoon levee reduced from 10 feet NGVD to 6 feet NGVD (designed to settle to the design elevation of 5 feet NGVD);
- Construction elevation of new levees reduced from 12 feet NGVD to 10 feet NGVD (designed to settle to the design elevation of 8 feet NGVD);
- Relocation of new outboard levee to 1,500 feet south or east of the existing BMK south lagoon levee, with the exception of the area between Pacheco Pond and the south lagoon levee where project design requires the levee remain 1,000 feet from the existing levee (prior location was all 1,000 feet or less from south lagoon in initial design);
- Improvements to levee west of the BMK south lagoon lock structure to minimize Novato Creek bypass flows to south lagoon;
- Removal of Spur Trail Option 2A to Novato Creek; routing of Bay Trail around west side of Headquarters Hill;
- Relocation of the interpretive center and access area from BMKV to the property currently owned by the City of Novato west of the HWRP (the “bulge” parcel); and
- Designation of primary construction road access from Nave Drive to New Hamilton Parkway, around Landfill 26 and to the HWRP and secondary access from Bel Marin Keys Boulevard

## Overview of Revised Alternative 2

Figures 3-5 and 3-6 show Revised Alternative 2 at maturity. Under Revised Alternative 2, tidal (tidal marsh, tidal flat, subtidal) and nontidal (high-transitional marsh, seasonal wetlands, upland) habitat types would be restored to the expansion site. Imported dredged material (determined to be suitable wetland cover material by the DMMO) would be used to create upland and seasonal wetland habitats, and to create surface elevations suitable to accelerate the establishment of tidal marsh vegetation. Final marsh plain elevations would develop over time through the natural deposition of sediments from San Pablo Bay, supporting the establishment of tidal marsh vegetation. The acreage of each habitat type restored under Revised Alternative 2 is shown in table 3-4 below.

**Table 3-4.** Summary of Revised Alternative 2: Dredged Material Placement with Seasonal Wetland and Enlarged Pacheco Pond

Habitats	899 acres tidal wetland 120 acres subtidal and tidal mudflat habitat 277 acres seasonal wetland 21 acres open water (pond) 12 acres emergent freshwater wetlands 247 acres upland
Outboard Levee Breaches	Novato Creek (BMKV); San Pablo Bay (BMKV)
Novato Sanitary District Outfall	Access road/berm (4–6' NGVD) and extension of 400' of new pipeline around east side of Pacheco Pond. Authorized HWRP already includes replacement/retrofit of existing pipeline and relocation of dechlorination plant.
New Levees	From enlarged Pacheco Pond to Novato Creek (8–10' NGVD). Along north and south sides of seasonal wetland (8–10' NGVD) Around east side of enlarged Pacheco Pond (8–10' NGVD)
Improved Levees	BMK south lagoon (5–6' NGVD)
Water Management Structures/Pacheco Pond and BMK S. lagoon connections	Overflow structure from Pacheco Pond to seasonal wetland Overflow structure from seasonal wetland to tidal wetland area Culvert with flapgate in Novato Creek levee to drain swale area Modified BMK lagoon overflow
Bay Trail, Interpretive Center, and Access Area	Along southwest perimeter of HWRP and north from city levee and along east side of Pacheco Pond to Bel Marin Keys Blvd around the west side of Headquarters Hill. Interpretive center and access area on property currently owned by the City of Novato west of HWRP seasonal wetland area.

## Tidal Wetland Design

In the eastern portion of the site, 2 tidally influenced sub-basins, each approximately 600 acres in size (the southern basin includes the SLC site), would be created as cells to facilitate the placement of dredged material and the establishment of tidal marsh vegetation. Dredged material would be placed in

each sub-basin to create surface elevations ranging from approximately 2 feet NGVD (1 foot below MHW) along the basin perimeter to approximately 0 NGVD near the outboard levee. Additional dredged material would be placed in the southeast corner of the SLC site to create surface elevations (approximately 3.5 feet NGVD) suitable for the establishment of high-transitional marsh vegetation. Material would also be placed along the east side of the new outboard levee to create elevations suitable for the establishment of high-transitional marsh. After placement activities have been completed, the outboard levees would be breached in 2 locations to restore the hydrologic connections to San Pablo Bay and Novato Creek. The levee along Novato Creek would be lowered to facilitate overflow onto the expansion site from Novato Creek during peak storm events. The levee along San Pablo Bay would also be lowered to facilitate the establishment of mid-high marsh vegetation. Several small portions of the outboard levees would be left in place as high-tide refugia. Final marsh plain elevations would be established through the deposition of fine-grained sediments from San Pablo Bay and Novato Creek. Final surface elevations in the 2 marsh sub-basins would range from approximately 0.5 to 3.5 feet NGVD. Elevations in the channel bottoms would ultimately be lower, particularly at the breach.

## Levees and BMK Lagoon Drainage

A new outboard levee running generally north-south with an initial elevation of approximately 10 feet NGVD (which includes a 2-foot settlement allowance, resulting in a design elevation of 8 feet NGVD) would be constructed across the middle portion of the site to separate the non-tidal and tidal habitats. The outboard (east) side of the levee would be constructed with a gentle side slope that would transition from upland to high- to mid-marsh habitat types. The inboard (west) side of the outboard levee would slope gradually from the crest of 10 feet NGVD to a base elevation of approximately -1.5 feet NGVD.

A new levee would cross from the new outboard levee to the east side of an expanded Pacheco Pond. This levee would separate a swale basin adjacent to the BMK south lagoon from a seasonal wetland basin to the south connected to Pacheco Pond. See figure 3-13 after page 3-38 of this section.

The existing levee along the BMK south lagoon would be improved to an initial top elevation of 6 feet NGVD, which includes a 1-foot settlement allowance, resulting in a design elevation of 5 feet NGVD. An overflow structure or structures would be installed to convey overflow from the south lagoon into the swale area. Overflow from the lagoon as well as seasonal precipitation would support the establishment of approximately 140 acres of seasonal wetland habitat in the swale basin. Plant species composition in this area would vary according to salinity and inundation frequency and duration; however, vegetation would likely consist of emergent wetland vegetation (e.g., bulrushes, cattails, rushes), and grasses and forbs. The swale basin would be about 387 acres overall including the 140-acre seasonal wetland and 247 acres of upland. The

approximate ponding capacity of the swale below 1.5 feet NGVD would be at about 450 acre-feet (AF). The capacity of the seasonal wetland would be greater than this amount due to the ability of this area to fill up to the elevation of the surrounding levee. For example if the swale were to fill to 3.5 feet NGVD, the ponded volume would be over 1000 AF.

Conceptual levee designs are shown in figure 3-13 after page 3-38 of this section.

## **Nontidal Habitat Design and Pacheco Pond Connection**

Under Revised Alternative 2, Pacheco Pond would be expanded by 21 acres on its east side. The expanded pond would also include 12 acres of emergent marsh habitat on its east border with the Bay Trail. A new levee would be constructed around the new eastern boundary of Pacheco Pond. The existing Pacheco Pond levee would be breached in several locations to unify the existing and new portions of the pond. Several portions of the existing levee may be left in place to create habitat islands. The approximate additional ponding capacity in the expanded pond and emergent wetland (up to 7 feet NGVD) would be approximately 175 AF.

In the southwestern portion of the expansion site, approximately 136 acres of seasonal freshwater wetlands (e.g., cattails, bulrushes, sedges) would be created by constructing surrounding levees to impound freshwater flows and by routing overflow from the expanded Pacheco Pond. The outboard levee would also prevent the seasonal wetland habitat area from being inundated during high tides. An overflow structure would be installed in the new levee around the east side of the expanded Pacheco Pond levee to facilitate overflow into the seasonal wetland habitat area when surface water elevations in Pacheco Pond exceed 1.5 feet NGVD (the managed surface water elevation). A flow structure would be installed in the new outboard levee to allow the release of overflow waters from the seasonal wetlands into the tidal marsh basin. A significant portion of Pacheco Pond flood flows may be released into the tidal marsh basin via the seasonal wetland. The bottom elevation of the seasonal wetland would be approximately -1.5 feet NGVD. The ponding capacity of the seasonal wetland below 1.5 feet NGVD would be about 400 AF. The capacity of the seasonal wetland would be greater than this amount due to the ability of this area to fill up to the elevation of the surrounding levee. For example if the seasonal wetland were to fill to 3.5 feet NGVD, the ponded volume would be around 650 AF.

Under this alternative, Pacheco Pond would have 2 outlets: the existing outlet to Novato Creek via the outlet channel, and a new outlet to the seasonal wetland area on BMKV. DFG and MCFCWCD have an existing agreement to manage Pacheco Pond for the dual purposes of flood control and wildlife uses. The BMKV expansion would include development of a new water management plan for Pacheco Pond, which the Conservancy (or its successors), DFG, and MCFCWCD would jointly implement to continue to manage flood control and wildlife. The existing outlet would continue to operate and would receive all

flow in the dry season because the seasonal wetlands would not require dry season flow. The new water management plan would determine the operational parameters of the 2 outlets in the wet season and during high-stage/flow events.

## **Novato Sanitary District Outfall**

The authorized HWRP includes the relocation of the NSD dechlorination plant and the replacement or retrofit of the existing NSD pipeline as described above under Alternative 1. This alternative includes construction of an access road/berm and construction of a new section of pipeline (approximately 400 feet) around the east side of the expanded Pacheco Pond

NSD would access the pipeline by existing, new, or improved levees leading to an improved berm along the existing alignment (at the property line separating BMKV from HAAF). The top of the berm would be built to between 4 and 6 feet NGVD, which is similar to Alternative 1, except that under Revised Alternative 2, a 2,000-foot section of levee southeast of Pacheco Pond would be built to between 8 feet and 10 feet NGVD because this portion would separate the seasonal wetland area from a part of the HAAF parcel that could receive tidal flow.

## **Bay Trail, Interpretive Center, and Access Area**

Under this alternative, the Bay Trail would be extended southward from the terminus of the existing trail at the pump station near the Hamilton baseball field, and then proceed along the southwestern perimeter of the HWRP to a point approximately 700 feet from the existing outboard marsh, as described above for Alternative 1 (routing of the Bay Trail at Hamilton is shown on figure 3-5 and on figure 4-10 in the *Biological Resources* section in chapter 4).

Also under this alternative, the Bay Trail would proceed northward from the City of Novato levee along the western edge of the HWRP to Pacheco Pond, cross the levee between Pacheco Pond and the HWRP, proceed around the east side of the expanded Pacheco Pond, and then proceed northward along the levee between Pacheco Pond and BMKV to Bel Marin Keys Boulevard around the west side of Headquarters Hill. This trail would be entirely on state or federal property. Revised Alternative 2 does not include a spur trail option to Novato Creek.

In addition, an interpretive center for the HWRP and BMKV expansion would be located on property currently owned by the City of Novato in the same location as described above under Alternative 1. The interpretive center is conceptually envisioned as an approximately 1,000-square-foot building that would house exhibits that provide information about the wetland restoration projects and the local flora and fauna. The interpretive center would serve as a trailhead and would be connected to the proposed Bay Trail route by new trails along existing dirt roads.

Since the interpretive center will be placed on lands that are not required for federal project purposes, and since Corps policy greatly limits expenditures for educational facilities, the interpretive center will not be a project feature to be paid for or constructed by the federal government. The land required for the interpretive center is outside the Federal project. However, the project design has accommodated the interpretive center construction, which would be carried out by others. The federal government will be able to share the expenses of some recreation features, including a parking area (approximately 10-20 spaces), restrooms, and information kiosks. These features would take up about 2 acres and are referred to collectively in this document as the “access area.” Only land required for these approved features can be cost-shared by the Federal government.

## Habitat Benefits

Revised Alternative 2 would provide 899 acres of tidal wetland, 120 acres of other tidal habitats, 277 acres of seasonal wetland, 21 acres of open water, 12 acres of emergent wetland and 247 acres of upland. Restoration of the proposed habitats would benefit numerous special-status and common wildlife species, similar to Alternative 1, except that Revised Alternative 2 would include a comparatively larger seasonal wetland component, smaller pond component, and slightly smaller tidal marsh component. See discussion of the species that would be expected to utilize restored habitats above under “Habitat Benefits” for Alternative 1.

## Construction Approach, Revised Alternative 2

Construction activities that would be implemented under Revised Alternative 2 to restore salt marsh, seasonal wetland, and upland habitats at the BMKV site are similar to Alternative 1. This section discusses any differences to the activities described for Alternative 1. As in Alternative 1, construction activities to restore habitats on the site would be implemented in 3 phases.

- Phase 1 – Site Preparation
- Phase 2 – Dredged Material Placement
- Phase 3 – Earthwork, Revegetation, and Tidal Connection

Figure 3-7 illustrates the construction effort associated with Revised Alternative 2.

## **Phase 1 – Site Preparation**

### **Create Staging Area and Site Access**

The staging area would be the same as that described above for Alternative 1. The primary construction site access route would be from Nave Drive and New Hamilton Parkway around Landfill 26 to the HWRP. The secondary construction site access route would be from Bel Marin Keys Boulevard.

### **Modify and Remove Existing Infrastructure**

Activities would be similar to that for Alternative 1.

### **Excavate and Salvage Topsoil**

This activity would be similar to Alternative 1, except that the area of potential use for salvage topsoil for seasonal wetland restoration would be far larger.

### **Construct Levees**

Levee construction and design would be similar to that described for Alternative 1, however, the location and length of levees differs as shown in the design figures and noted below.

#### ***New and Improved Levees/Berms***

New levees, approximately 21,000 feet in length, would be constructed across the middle and western portions of the site to create habitat features (e.g., freshwater seasonal wetlands), to separate the tidal and non-tidal portions of the site, and to provide appropriate levels of flood protection for adjacent landowners. These new levees would be constructed to an initial elevation of 10 feet NGVD (which includes a 2-foot settlement allowance, resulting in a design elevation of 8 feet NGVD). In order to maintain the 8-foot-NGVD design elevation, it will be necessary to return twice after initial settling has occurred and raise the levee to 10' NGVD again. This would occur approximately 6.5 years and 13 years after commencement of construction. The second raising of the levee would occur just prior to final breaching of the last tidal cell.

Approximately 36,400 linear feet of existing levees/berms along the perimeter of the site would be improved to facilitate the placement of dredged material. The improved levee along the Bel Marin Keys south lagoon would be constructed to an initial elevation of 6 feet NGVD (which includes a 1-foot settlement allowance, resulting in a design elevation of 5 feet NGVD). Much of the existing levee is already at 5 feet NGVD, and construction effort at those locations would be less than at several low points where the lagoon levee reaches between approximately 2 and 3 feet NGVD.

Under this alternative, the berm along the southern perimeter of the site (between BMKV and HAAF) would be built to 4 to 6 feet NGVD in the area east of the seasonal wetland area on the BMKV site. Construction of the berm may also include improvements to several short sections of the western perimeter levee.

Improvements to approximately 440 feet of the existing levee west of the BMK south lagoon lock have been added to the levee construction.

Since the trail design may mean that the Bay Trail is to be located on top of or on the slope of an existing, new, or improved levee, trail construction would be incorporated during levee work in Phase I. The trail would not be open for use during periods of construction because of safety concerns. Trail improvements such as gates, signs, or other elements would be added as soon as feasible, consistent with construction activities.

### ***Phase Levees***

Prior to transporting and placing dredged material, a series of internal levees (approximately 19,200 linear feet) would be constructed within the expansion site to facilitate phasing. The expansion site would be divided into 2 subunits based on drainage basin size and configuration.

### ***Interior Berms and Peninsulas***

A series of berms and interior peninsulas (approximately 18,200 linear feet) would be constructed within the marsh basins for the reasons described under Alternative 1.

### **Construct Water Quality Detention Ponds**

The expansion site would be subdivided into drainage basins approximately 600 acres in size (corresponding to the phase units described previously). A pilot channel approximately 150 feet wide and 800 feet long would be excavated in each marsh basin. The operation of the ponds would be as described above for Alternative 1.

### **Construct Dredged Material–Related Infrastructure**

#### ***Material Off-loading Facility***

This facility would be the same as described above for Alternative 1.

#### ***Primary Delivery Pipeline***

This facility would be the same as described above for Alternative 1.

#### ***Booster Pump Facility***

This facility would be the same as described above for Alternative 1.

#### ***Secondary Distribution Pipelines***

This facility would be the same as described above for Alternative 1.

## **Phase 2 – Dredged Material Placement**

### **Pump Dredged Material**

Approximately 13.8 million additional cubic yards of dredged material (beyond that in the authorized HWRP) would be imported to the expansion site for creation of tidal and nontidal habitats, which is 600,000 cubic yards more than

Alternative 1. Dredged material would originate from the same sources as described in Alternative 1. Pumping activity would be the same as described above for Alternative 1.

The Corps and Conservancy are willing to accept dredged material from BMK CSD and MCFCWCD (from Novato Creek dredging events) if they are determined to be suitable wetland cover material by the DMMO, their reuse is cost-effective to the project and the timing and other parameters of the dredge material's availability are consistent with the project implementation process.<sup>2</sup>

### **Treat Decanted Water and Discharge**

Handling of decant water would be the same as described above for Alternative 1.

## **Phase 3 – Earthwork, Revegetation, and Tidal Connection**

### **Return Levee Improvement of New Levees**

In order to maintain the 8' NGVD design height, it would be necessary to raise the new levee to 10' NGVD about 6.5 years after initial construction and again just prior to breaching of the outboard levees, which is anticipated to occur approximately 13 years after commencement of construction. This will allow for the initial settling to occur during the construction period and maintenance of the design height.

### **Grade Phase Levees to Finished Grade**

This activity would be the same as described above for Alternative 1.

### **Create Habitats Through Use of Salvaged Topsoil**

This activity would be the same as described above for Alternative 1.

### **Seed/Plant Nontidal Habitat Areas**

This activity would be the same as described above for Alternative 1.

### **Install Water Management Structures**

During the final phases of construction, a number of flow control structures (e.g., culverts, weirs) (see figure 3-5) would be installed to facilitate future water management activities. An overflow structure would be installed in the new levee around the east side of the expanded Pacheco Pond to facilitate overflow into the seasonal wetland habitat. An overflow structure (equivalent in capacity to six 4-foot by 4-foot box culverts) would be installed in the new outboard levee to enable the release of overflow waters from the seasonal wetland habitat area into the tidal marsh basin. The existing overflow from the BMK lagoon located in the northern portion of the site would be modified and additional culverts would be installed to facilitate overflow into the constructed swale during storm events. An additional culvert with a flapgate, approximately 48 inches in width, would be installed in the existing Novato Creek levee to allow the swale to drain into Novato Creek.

### **Complete Trail Improvements**

Trail construction would be conducted in Phase I along with levee work, since the Bay Trail would be constructed along existing and new levees on the west side of BMKV. Trail improvements, such as gates, fences, signs, benches, and other elements, would be built as soon as feasible, consistent with construction activities.

### **Excavate Connecting Channel and Breach Levees**

Upon completion of dredged material placement activities, the water quality detention basins would be filled to the final placement grade, pilot channels approximately 150 feet wide by 800 feet long would be excavated in each marsh basin, and the perimeter levee would be breached to restore the tidal connection with San Pablo Bay and Novato Creek. This activity would be the same as described above for Alternative 1, although only two breaches, rather than three would be excavated. On either side of the San Pablo Bay levee breach, the outboard levee would be lowered to an elevation between MHW and MHHW to create topographic diversity, promote establishment of mid- to high-marsh vegetation, and provide refugia for wildlife species. Additionally, the levee along Novato Creek would be lowered to approximately MHW to facilitate overflow onto the expansion site from Novato Creek during peak storm events. Levee breaching and grading and channel excavation would involve a variety of heavy equipment, including track-, mat-, or pad-mounted excavators; backhoes; bulldozers; dump trucks; draglines; and/or a suction dredge.

The existing Pacheco Pond levee would be breached in several locations to unify the existing and new portions of the pond. Several portions of the existing levee may be left in place to create habitat islands. The adjacent portions of the Pacheco Pond levee (e.g. not within the new pond area) would remain.

## **Construction Timing, Revised Alternative 2**

Under Revised Alternative 2, overall site construction is estimated to last approximately 13 years; anticipated overall durations of the 3 construction phases are as follows.

- Phase 1: Site preparation – 2 years
- Phase 2: Dredged material placement – 10 years (includes placement and dewatering and consolidation)
- Phase 3: Earthwork and tidal connection – 1 year

As noted above, this alternative includes two tidal sub-basins and other habitat areas such as the swale and the seasonal wetland area, separated by either temporary or permanent levees. Restoration activities could be conducted based on sub-basin boundaries and/or habitat types, to allow for sequential creation of habitat. Fill could be placed either sequentially or concurrently in different basins and/or habitat types. As one example of the sequential approach, dredged

material placement in one of the tidal cells would take about 5 years. Upon completion of dredged material placement, breaching of this tidal cell could take place prior to filling of the other cell. For the first tidal cell, construction time to tidal breach could be around 8 years in a sequential approach.

The Revised Alternative 2 schedule is also dependent in part upon completion of the FUDS remedial activities on the SLC parcel on the authorized HWRP site. Because there is no separating levee between BMKV and the SLC parcel in this alternative, breaching into the southern cell cannot be completed until the FUDS remedial activities have been completed and the placement of additional dredged material to create high tidal marsh has been completed.

## **Alternative 3 – Natural Sedimentation with Enlarged Pacheco Pond**

### **Overview of Alternative 3**

Figures 3-8 and 3-9 show Alternative 3 at maturity. Under Alternative 3, tidal (tidal marsh, tidal flat, subtidal) and nontidal (high-transitional marsh, emergent wetlands, perennial open water and upland) habitat types would be restored to the expansion site. Site soils and sediments would be used to establish the base for the high transitional marsh and upland transition on the majority of the expansion site. On 90 acres in the southeastern corner of the SLC parcel, dredged material would be placed to established high transitional marsh habitat. Final marsh plain elevations and vegetation would become established over time through the natural deposition of sediments from San Pablo Bay. The acreage of each habitat type that would be restored under Alternative 3 is shown in table 3-5.

**Table 3-5. Summary of Alternative 3: Natural Sedimentation with Enlarged Pacheco Pond**

Habitats	1,274 acres tidal wetland 197 acres subtidal and tidal mudflat habitats 40 acres of open water 10 acres of emergent marsh 55 acres upland
Outboard Levee Breaches	San Pablo Bay (BMKV); San Pablo Bay (BMKV)
Novato Sanitary District Outfall	New pipeline along east side of Pacheco Pond with access road/berm (4–6' NGVD). Authorized HWRP already includes replacement/retrofit of existing pipeline and relocation of dechlorination plant.
New Levees	Immediately south of BMK south lagoon to Novato Creek (8–12' NGVD). Along east side of expanded Pacheco Pond.
Improved Levees	BMK south lagoon (6–10' NGVD)
Water Management Structures/Pacheco Pond and BMK south lagoon connections	Culvert with flapgate on east side of expanded Pacheco Pond Pump to accommodate BMK lagoon overflow near BMK lock
Bay Trail, Interpretive Center and Access Area	Along southwest perimeter of HWRP and north from City levee and along east side of expanded Pacheco Pond to Bel Marin Keys Blvd. Spur Option 3A from Pacheco Pond to Novato Creek. Interpretive Center and Access Area on northwest side of BMKV.

## Tidal Wetland Design

In the eastern portion of the site, 2 tidally influenced sub-basins, each approximately 700 acres in size, would be created as cells to facilitate the establishment of tidal marsh vegetation. The outboard levee would be breached in 2 locations to restore the hydrologic connection to San Pablo Bay. Final marsh plain elevations would be established through the natural deposition of fine-grained sediments from San Pablo Bay. Final surface elevations in the 2 marsh sub-basins would range from approximately 0.5 to 3.5 feet NGVD.

## Levees and BMK Lagoon Drainage

A levee with an initial elevation of approximately 12 feet NGVD (which includes a 4-foot settlement allowance, resulting in a design elevation of 8 feet NGVD) would be constructed along the northwestern portion of the site following the existing BMK south lagoon levee. The outboard (east) side of the levee would be constructed with a gently sloping bench, approximately 100 feet wide, to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat. The inboard (west) side of the levee would slope gradually from the crest of 12 feet to a base elevation of 5 feet below NGVD. The western portion of the existing BMK south lagoon levee near Bel Marin Keys Boulevard would be improved to an initial top elevation of 10 feet NGVD (which includes a

4-foot settlement allowance, resulting in a design elevation of 6 feet NGVD). A pump would be installed near the east navigation lock to convey overflow from the south lagoon into Novato Creek.

A second bench, also approximately 100 feet wide, would be constructed along the north side of the existing levee that separates the expansion site from the HAAF parcel to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat.

Conceptual levee designs are shown in figure 3-12 after page 3-38 of this section.

## **Nontidal Habitat Design and Pacheco Pond Connection**

In the northwestern portion of the expansion site, approximately 50 acres of perennial open water and wetland habitat would be created by enlarging Pacheco Pond. The levee that now separates the expansion site from Pacheco Pond would be breached in several locations to provide a larger contiguous area of open water habitat. Sections of the levee would be left in place to provide nesting habitat for shorebirds. The bottom elevation of Pacheco Pond would remain at the existing elevation of -3 feet NGVD, and the pond would continue to be managed to maintain a surface water level of approximately 1.5 feet following enlargement of the pond. A bench would be constructed along the inboard perimeter of the new pond levee to promote the establishment of freshwater emergent vegetation. A culvert structure would be installed in the new pond levee to allow the release of overflow waters from the pond into the tidal marsh basin.

Under this alternative, Pacheco Pond would have 2 outlets: the existing outlet to Novato Creek via the outlet channel, and a new outlet to the tidal wetland area on BMKV. DFG and MCFCWCD have an existing agreement to manage Pacheco Pond for the dual purposes of flood control and wildlife. The BMKV expansion would include development of a water management plan for Pacheco Pond, which the Conservancy or successors, DFG, and MCFCWCD would jointly implement to continue to manage flood control and wildlife.

## **Novato Sanitary District Outfall**

The authorized HWRP includes relocation of the NSD dechlorination plant and replacement/retrofit of the existing pipeline. Under this alternative, a new outfall extension would be installed around the east side of the expanded Pacheco Pond, and an access road/berm would be added to the HWRP. The existing pipeline would be replaced or retrofitted as part of the HWRP because of potential differential settling and leakage (U.S. Army Corps of Engineers 2001b). If a new pipeline is installed, it would be installed slightly below the grade of the existing pipeline; the existing pipeline would be abandoned in place to provide protection from potential scour associated with the formation of tidal channels. The new NSD pipeline would be placed in a new alignment around the eastern side of

Pacheco Pond. The pipeline would be installed deeper than the invert for the outlet culverts from Pacheco Pond to the tidal wetland restoration area.

NSD would access the pipeline by existing or new levees leading to an improved berm along the existing alignment (at the property line separating BMKV from HAAF). The top of the berm would be built to between 4 and 6 feet NGVD.

As part of the authorized HWRP project, the existing NSD dechlorination plant would be relocated to NSD's Ignacio Treatment Plant, Novato Treatment Plant, or another suitable location. Relocating the dechlorination plant would avoid the need to provide an alternative power supply to the plant and would make the plant more easily accessible to NSD personnel for operation and maintenance.

## Bay Trail, Interpretive Center and Access Area

Under this alternative, the Bay Trail would be extended southward from the terminus of the existing trail at the pump station near the Hamilton baseball field. and then proceed along the southwestern perimeter of the HWRP to a point approximately 700 feet from the existing outboard marsh, as described for Alternative 1 (routing of the Bay Trail at Hamilton is shown on figure 3-8 and on figure 4-10 in the *Biological Resources* section in chapter 4).

Also under this alternative, the Bay Trail would extend northward from the City of Novato levee along the western edge of the HWRP to Pacheco Pond, then cross the levee between Pacheco Pond and the HWRP, then follow the expanded Pacheco Pond levee, and then proceed northward to Bel Marin Keys Boulevard. This alignment is entirely on state or federal property.

Spur Option 3A would include a spur trail extending eastward from the Bay Trail at Pacheco Pond along the proposed levee that separates the upland buffer/swale area from restored tidal wetlands to the BMK south lagoon, and then proceeding east along the new levee south of the BMK south lagoon levee to Novato Creek. This spur would terminate at Novato Creek, where a gate would be installed to prevent trail users from entering the BMK residential area.

Under this alternative, an interpretive center for the HWRP and BMKV expansion would be constructed on the northwestern portion of the expansion site, south of Bel Marin Keys Boulevard. The features of the center are the same as described for the other alternatives; only the location is different.

Corps policy greatly limits expenditures for educational facilities and thus the interpretive center will not be a project feature to be paid for or constructed by the federal government. However, the project design has accommodated the interpretive center construction, which would be carried out by others. The federal government will be able to share the expenses of some recreation features, including a parking area (approximately 10-20 spaces), restrooms, and information kiosks.

## Habitat Benefits

Alternative 3 would provide 1,274 acres of tidal wetland; 197 acres of other tidal habitats; 40 acres of open water; 10 acres of emergent marsh, and 55 acres of upland. Restoration of the proposed habitats would benefit numerous special-status and common wildlife species for tidal and non-tidal areas restored, similar to Alternative 1, except Alternative 3 would not include any seasonal wetlands.

## Construction Approach, Alternative 3

Construction activities that would be implemented under Alternative 3 to restore salt marsh, an expanded Pacheco Pond, and upland habitats at the BMKV site are similar to Alternative 1. This section discusses any differences to the activities described for Alternative 1. As in Alternative 1, construction activities to restore habitats on the site would be implemented in 3 phases.

- Phase 1 – Site Preparation and Earthwork
- Phase 2 – Dredged Material Placement (on 90 acres on SLC site only)
- Phase 3 – Revegetation and Tidal Connection

In this alternative, the placement of dredged material is limited to 90 acres on the SLC site. Figure 3-10 shows the construction effort associated with Alternative 3.

### Phase 1 – Site Preparation

#### Create Staging Area and Site Access

This activity would be similar to that described above for Alternative 1.

#### Modify and/or Remove Existing Infrastructure

This activity would be the same as that described above for Alternative 1.

#### Excavate and Salvage Topsoil

This activity would be the same as that described above for Alternative 1, except that salvaged topsoil would not be used for construction of seasonal wetlands, since none are included in this Alternative.

#### Construct Levees

A variety of levees would be constructed on the expansion site to facilitate creation of habitat features and to provide appropriate levels of flood protection for adjacent landowners. A dredged-material placement levee would be built on the southeast portion of the SLC parcel. Design parameters and function would vary by levee type. Site preparation techniques and construction activities would typically be the same as that described for Alternative 1 above.

***New and Improved Levees/Berms***

A new levee (approximately 11,000 feet) would be constructed across the western portion of the site to create habitat features (e.g., open water and freshwater emergent wetlands) and provide appropriate levels of flood protection for adjacent landowners. A gently sloping bench, approximately 100 feet wide, would be constructed along the outboard side of the containment levee to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat.

Approximately 9,000 linear feet of existing levees/berms would be improved to protect adjacent parcels. The berm along the southern perimeter of the site (between BMKV and HAAF) would be constructed to 4 to 6 feet NGVD under this alternative. A second bench, approximately 100 feet wide, would be constructed along the north side of the existing levee that separates the expansion site from the HAAF parcel to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat.

Since this alternative included a pumping station, vehicle access to the pumping station would be necessary. The new levee along the BMK south lagoon would need to be designed to accommodate vehicle access for maintenance, fueling, and service of the pump station. It may also be necessary to install an electrical line in the levee to reach the pump station if the pumps are electrically driven.

***Phase Levee***

Prior to restoring tidal action, an internal levee (approximately 6,500 linear feet) would be constructed within the expansion site to facilitate phasing. The site would be divided into 2 subunits based on drainage basin size and configuration.

***Interior Berms and Peninsulas***

A series of berms and interior peninsulas (approximately 26,500 linear feet) would be constructed within the marsh basins to promote sediment settling, reduce resuspension of sediments due to wind/wave mixing, decrease fetch, and reduce wave erosion of perimeter and containment levees.

One of the internal berms would enclose the 90-acre dredged material placement cell in the southeastern corner of the SLC parcel. The berm would have a minimum top width of 4 feet and a elevation of approximately 2 feet above the finished placement grade. Dredged materials would be placed in this cell in coordination with material placed on the adjacent HAAF site.

## **Phase 2 – Dredged Material Placement**

### **Pump Dredged Material**

Dredged material would only be used on 90 acres in the southeast corner of the SLC parcel under this alternative. Pumping activity would be the same as Alternative 1, except the scale of activity would be significantly lower due to the use of dredged material on 90 acres on the SLC parcel and no use of dredged material to establish tidal elevations on the BMKV site.

Approximately 1,200,000 cubic yards of dredged material would be imported to the southeast corner of the SLC site to create high transitional marsh habitat on 90 acres. Overall, this alternative would result in using 2.6 million cubic yards less of dredged material than the authorized HWRP, due to the reduction in the amount of material placed on the SLC site. Dredged material would originate in the same sources noted above for Alternative 1. Placement and draining operations would continue until the desired surface elevations (3.5 feet NGVD) have been reached in the 90-acre area.

### ***Material Off-loading Facility***

This facility would be the same as described above for Alternative 1.

### ***Primary Delivery Pipeline***

This facility would be the same as described above for Alternative 1, except that it is likely that the pipeline alignment would be on the HAAF site.

### ***Booster Pump Facility***

This facility would be the same as described above for Alternative 1.

### ***Secondary Distribution Pipelines***

This facility would only extend onto the SLC site.

### **Treat Decanted Water and Discharge**

As solids settle from the slurry, clarified water would be decanted and discharged to a water quality detention pond at the mouth of the main channel at the breach nearest the 90-acre area (location to be determined). This activity otherwise be that same as that described above for Alternative 1.

## **Phase 3 – Soil Placement, Revegetation, and Tidal Connection**

### **Create Habitats through Use of Salvaged Topsoil**

This activity would be the same as in Alternative 1.

### **Seed/Plant Nontidal Habitat Areas**

This activity would be the same as in Alternative 1.

### **Install Water Management Structures**

During the final phase of construction, a number of flow control structures (e.g., culverts, weirs) would be installed to facilitate future water management activities. An overflow structure (equivalent in capacity to six 4-foot by 4-foot box culverts) would be installed in the new Pacheco Pond levee to enable the release of overflow waters from the pond into the tidal marsh basin.

A pump with an outfall to Novato Creek would be installed near the eastern navigation lock to pump water from the BMK south lagoon during large storm events. If the pump uses diesel or gasoline fuel, then a fuel storage tank would need to be built at the pump station, including any necessary fuel spill containment areas for fuel transfers and tank containment.

### **Excavate Connecting Channel and Breach Levee**

Upon completion of site preparation activities, pilot channels approximately 150 feet wide and 800 feet long would be excavated in each marsh basin, and the perimeter levee would be breached to restore the tidal connection with San Pablo Bay.

## **Construction Timing, Alternative 3**

Under Alternative 3, site construction is expected to last approximately 5 years. Anticipated durations of the 3 phases are as follows.

- Site preparation – 2 years
- Dredged material placement – 1 to 2 years (includes placement, dewatering, and consolidation)
- Earthwork and tidal connection – 6 months to 1 year

The Alternative 3 schedule is dependent in part upon completion of the FUDS remedial activities on the SLC parcel on the authorized HWRP site. Because there is no separating levee between BMKV and the SLC parcel under this alternative, breaching into the southern cell could not be completed until the FUDS remedial activities have been completed and the placement of additional dredged material to create high tidal marsh has been completed. In the event that FUDS remedial activity is not completed when construction commences for this alternative, the construction duration could be longer than 5 years or could be separated into a number of phases for the 2 separate cells.

## **Comparison of Restoration Alternatives**

Table 3-6 is a summary comparison of the activities proposed under each restoration alternative. Alternatives 1 and 2 rely on placement of clean dredged materials as fill to establish a grade close to the final desired condition, with

natural processes responsible for development to final conditions over time. Alternative 3 relies on natural depositional and erosional processes for all phases of restoration development, except for a small (90-acre) area in the southeastern portion of the site, where dredged materials would be placed. The principal differences between the 3 alternatives are related to

1. logistical and time considerations associated with dredged material placement, including construction of infrastructure for delivery and placement of dredged materials (Alternatives 1 and 2);
2. time to establishment of desired habitat conditions (all 3 alternatives); and
3. size and number of different habitat components.

Figure 3-11 shows the anticipated development of appropriate elevations for restored habitat after reestablishment of tidal connectivity for Alternatives 1, 2, and 3. The use of dredged materials to establish initial surface elevations in Alternatives 1 and 2 would greatly decrease the amount of time required for the establishment of tidal marsh vegetation and development of the desired habitat types in comparison with the time required for the establishment of appropriate elevations under the natural sedimentation approach in Alternative 3. Dredged material placement would thus provide habitat in a shorter amount of time for those species that use tidal marsh and associated aquatic habitats, as well as seasonal wetlands, freshwater marshes, and upland transition habitats. However, Alternative 3 would provide a greater amount of tidal wetlands, though several decades later than the alternatives that use dredged material. As described above and in the *Biological Resources* section in chapter 4, tidal wetlands provide suitable habitat for a number of threatened, endangered, rare, and common species.

While not shown in figure 3-11, freshwater vegetation establishment in seasonal wetland areas in Alternatives 1 and 2 would vary depending on whether dredged material or salvaged onsite soil were used as final wetland cover. Use of onsite soil is expected to result in earlier establishment of freshwater seasonal wetland vegetation but may also result in a greater amount of non-native vegetation establishment.

Figures 3-12 and 3-13 show the different conceptual designs for new levees, improved levees, an access berm, and the internal peninsulas.

1 **Table 3-6. Summary Comparison of Features Associated with the Expansion Alternatives**

	Expansion Alternatives		
	Alternative 1	Revised Alternative 2	Alternative 3
<b>Earthwork</b>			
New Levees	13,300 linear feet	21,000 linear feet	11,400 linear feet
Improved Levees/Berms	37,500 linear feet	36,400 linear feet	8,800 linear feet
Phase Containment Levees	30,400 linear feet	19,200 linear feet	6,500 linear feet
Internal Peninsulas/Berms	15,800 linear feet	18,200 linear feet	26,500 linear feet
Pilot Channel Excavation	2,100 linear feet	1,800 linear feet	1,200 linear feet
<b>Dredged Material</b>			
Dredged Material	13,200,000 cubic yards	13,800,000 cubic yards	1,200,000 cubic yards <sup>a</sup>
<b>Time to Construct</b>			
Site Preparation	2 years	2 years	2 years
Dredge Material Placement	10 years	10 years	1–2 years
Earthworks and Tidal Connections	1 year	1 year	0.5–1 year
<b>Habitat Acreage</b>			
Upland Transition	300 acres	247 acres	55 acres
Open Water	40 acres	21 acres	40 acres
Freshwater Emergent Wetland	10 acres	12 acres	10 acres
Seasonal Wetland	40 acres	277 acres	0 acres
High Transitional Marsh	160 acres	79 acres	30 acres
Tidal Marsh	849 acres	792 acres	1,204 acres
Low Marsh <sup>b</sup>	30 acres	28 acres	40 acres
Tidal Mudflat <sup>c</sup>	57 acres	48 acres	67 acres
Subtidal <sup>d</sup>	90 acres	72 acres	130 acres
<b>Water Management</b>			
Pacheco Pond: Modeled Change in Water Surface (10-year scenario; see Appendix B)	–1.9 feet	–1.8 feet	–1.9 feet
Pacheco Pond: Modeled Change in Water Surface (100-year scenario; see Appendix B)	–0.4 feet	–1.3 feet	–0.4 feet
Pacheco Pond: Change in Estimated Flood Storage Volume	+375 acre-feet	+650 acre-feet (in seasonal wetlands below 3.5' NGVD)	+375 acre-feet
Novato Creek: Change in Peak Water Surface Elevation (10-year storm event)	No change	No change	No change
Novato Creek: Change in Invert Elevation Downstream of Breach	–0.5 feet	–0.5 feet	No change

	Expansion Alternatives		
	Alternative 1	Revised Alternative 2	Alternative 3
<b>Time to Establishment of Target Elevations for Vegetation</b>			
Mud Flat	0 years	0 years	5 years
Low Marsh	0 years	0 years	15 years
Mid-High Marsh	10 years	10 years	40 years
<sup>a</sup> Represents fill associated with placement of dredged material on 90 acres on the southeast corner of the SLC parcel			
<sup>b</sup> MSL–MHW			
<sup>c</sup> MLLW–MSL (includes 2 acres of existing tidal mudflat on property)			
<sup>d</sup> MLLW			

## Alternatives and Alternative Features Dismissed from Further Consideration

Based on input received from the technical and public workshops conducted in fall 2001, a range of alternatives and alternative features was developed for consideration. These alternatives and features incorporated various options to meet the HWRP purpose and need as well as options to avoid or reduce some of the potential impacts of certain aspects of habitat restoration at the BMKV site. The full range of alternatives and features developed was evaluated for feasibility; ability to satisfy the stated HWRP purpose, need, goal, and objectives; and potential environmental effects. Based on this evaluation, a number of alternatives and alternative features were dismissed from further consideration, and Alternatives 1, 2, and 3 were selected as representing a reasonable range of alternatives for analysis in the SEIR/EIS. The following sections describe the alternatives and alternative features evaluated but dismissed from detailed consideration. Tables 3-7 and 3-8 provide a summary comparison of the alternatives and features dismissed from detailed consideration.

**Table 3-7.** Alternatives Considered but Eliminated from Detailed Analysis

Alternative Number	Descriptive Name	Summary	Key Screening Considerations
4	Varying Habitat Mixes	Create/restore a mosaic of habitats with <80 percent tidal component	Provides less habitat for special-status species than Alternative 1, 2, or 3
5	“Historic” Bay/Wetland Restoration	Restore site to circa-1850 habitat mosaic	Provides less habitat for common and special-status species than Alternative 1, 2, or 3
6	Hybrid of Dredged Material and Natural Sedimentation Approaches	Place dredged material as fill on part of the site and allow natural sedimentation to establish habitats on remainder of site	Represents “middle ground” between use of dredged material and natural sedimentation approaches; intent captured by range of 3 alternatives
7	Smaller Restoration Project	Limit fill/levee activities to the maximum allowed by existing F-2 zoning and drainage agreements (approx. 372 acres)	Does not meet intent of project sponsors and provides far more limited benefits to endangered species than Alternatives 1, 2, or 3.

**Table 3-8.** Alternative Features Considered but Eliminated from Detailed Analysis

Feature Number	Descriptive Name	Summary	Key Screening Considerations
8	Alternative Bay Trail Alignment along Outboard Levee	Route Bay Trail along outboard marsh levee with pedestrian bridges over breaches	Conflicts with conservation of habitat for special-status species; long-term management considerations; cost
9	Alternative Novato Sanitary District Wastewater Alignment	Route new NSD alignment along northern levee or along cell drainage divide; construct new outfall in San Pablo Bay	Divides site from Novato Creek; places new outfall close to mouth of Novato Creek. Significant impacts with only limited benefits.
10	In-Kind Replacement of Agricultural Wetlands	Replace existing agricultural wetlands with restored agricultural wetlands or a greater amount of seasonal wetland acreage	Provides less habitat for special-status species than Alternative 1, 2, or 3; replacement of agricultural habitat with out-of-kind wetlands in Alternative 1, 2, and 3 is considered ecologically appropriate. Requires additional maintenance for agriculture.
11	Extension of Tidal Reach to Pacheco Pond	Eliminate levee separating Pacheco Pond from BMKV and breach outboard levees	Eliminates flood benefits of Pacheco Pond; eliminates brackish habitat in Pacheco Pond; does not create a diverse array of habitats; provides no obvious benefits.
12	Removal of Berm Separating BMKV and HAAF Sites	Eliminate the berm separating the 2 restoration sites	Eliminates barrier to site integration but does not accommodate NSD outfall

Feature Number	Descriptive Name	Summary	Key Screening Considerations
13	Alternative Breach Location on Novato Creek	Move the breach location closer to the existing navigation lock	Conflicts with provision of upland buffer between site and BMK residences/lagoon; may create conflicts between sensitive wildlife and residential/recreational uses
14	Reclaimed Wastewater Alternative	Use reclaimed wastewater to enhance freshwater flows and habitats on site	Wastewater use not a purpose of HWRP; has potential to create water quality issues; flow augmentation unnecessary to achieve desired habitat acreages
15	Single Large-Basin, Single-Breach Alternative	Design the tidal portion of the site with only 1 basin and 1 breach	Single breach may not be adequate to support full hydraulic and biological function on restored marshlands; provides no obvious benefits
16	Flood Control Alternative Feature 1	Route Novato Creek flood flows through BMK south lagoon to large holding pond on BMKV (suggested by MCFCWCD based on 1993 BMKV EIR)	Flood control beyond that needed to mitigate project effects is not a purpose of the project. Holding area would eliminate ability to restore large portions of the site to tidal wetland. Alternatives 1, 2, and 3 determined not to have adverse physical effect on flooding.
17	Flood Control Alternative Feature 2	Construct a bypass channel starting near Highway 37 and move existing north-side Novato Creek levees northward (suggested by MCFCWCD based on 1993 BMKV EIR)	Flood control beyond that needed to mitigate project effects is not a purpose of the project. Bypass channel on lands not owned or under control of project sponsors. Impacts to existing habitat in creek. Impacts to use of land for NSD spray irrigation. Alternatives 1,2, and 3 determined not to have adverse physical effect on flooding.

## Alternative 4 – Varying Habitat Mosaics

Possible alternative habitat mosaics ranged from leaving the site in its present state to providing significantly less tidal marsh habitat and more seasonal marsh habitat to providing only tidal marsh habitat. The goal of the HWRP is to create a diverse array of wetland and wildlife habitats at HAAF and BMKV in order to benefit a number of special-status species as well as other migratory and resident species; the “all or nothing” alternatives, such as providing only tidal marsh habitat, were dismissed from further consideration because they would fail to provide a diversity of habitat. One of the needs for the HWRP is to provide habitat for endangered species; in the context of San Francisco Bay, this means providing habitat for endangered tidal marsh species, such as the salt marsh harvest mouse and the California Clapper Rail. Thus, alternatives that did not provide for restoration of substantial areas of tidal marsh were also dismissed from further consideration. Although a nearly infinite range of possible habitat

mosaics remain, the alternatives selected for detailed evaluation represent a reasonable range of habitat options, and other alternatives offering different percentages of the various habitat types were dismissed from further consideration.

## **Alternative 5 – “Historic” Bay/Wetland Restoration**

Circa 1850, the Bay shoreline was located near the eastern edge of the BMK south lagoon. Approximately half of the current BMKV site was part of the Bay at that time, while the remaining western portion of the site supported a tidal marsh complex that received freshwater flow directly from Pacheco Creek and Arroyo San Jose as well as overflow from Novato Creek (Pacheco Pond was built in the 1970s). It would be possible to restore this circa-1850 habitat mosaic by constructing a new outboard levee (built to an elevation between MHW and MHHW, with several breaches to allow tidal flow) along the approximate alignment of the 1850 shoreline, lowering the existing outboard levees, and placing dredged materials as fill or allowing natural sedimentation to create new tidal marsh on the western half of the site. Flow from Arroyo San Jose and Pacheco Creek would be diverted to discharge into the restored wetland area. This alternative was dismissed from further consideration because it would create far less tidal marsh habitat than Alternatives 1, 2, and 3, and thus would not meet the HWRP objectives as well as these alternatives.

## **Alternative 6 – Hybrid of Dredged Material and Natural Sedimentation Approaches**

Representing a “middle ground” between Alternatives 1–2 and Alternative 3, this alternative would place dredged material to create appropriate elevations for wetland restoration on a part of the site, and would rely on natural sedimentation for wetland restoration on the remainder of the site. This alternative was dismissed from further consideration because the 3 alternatives selected for analysis include a range that captures the intent of this alternative. If a dredged material placement alternative is selected for implementation and the availability of dredged material of suitable quality becomes a limiting factor at some point in the future, this alternative may be reevaluated.

## **Alternative 7 – Smaller Restoration Project**

This alternative would include placement of dredged material, establishment of levees, and tidal breaching on a far smaller portion of the BMKV site than envisioned under Alternatives 1, 2, and 3. The purpose of this alternative would be to avoid filling, creation of levees, placing structures, or undertaking any other activity that would result in diminishment of the nominal ponding capacity of the

site by greater than 25%, while maintaining the acreages of existing drainage agreements. The end result would be a restoration area of approximately 317 acres in size. This alternative could comply with the county flood zoning ordinances and existing drainage agreements. Levee structures, buffer areas, and a potential Bay Trail would reduce further the available area for wetland restoration. This alternative would result in far fewer benefits to endangered and other wetland-dependent species and would only represent a marginal addition to the habitat value overall of the HWRP. Further, this alternative does not meet the intent of the Conservancy when it purchased the property nor the intent of the Corps in early consideration of the potential to add BMKV to the HWRP. This alternative was dismissed from further analysis after completion of the first hydrologic study on the BMKV site and on Alternatives 1, 2, and 3 that showed that the expansion would not have an adverse effect on flooding in the local area. A second hydrologic study is being conducted presently on a broader study area to confirm the results of the first study. If this second study identifies an adverse physical hydrologic impact of the restoration alternatives analyzed in this document, then this alternative may be reconsidered for evaluation. In addition, if resolution about the F-2 zoning cannot be reached in a way that allows Alternative 1, 2, or 3 to proceed, this alternative may be reconsidered at some point in the future.

## Alternative Feature 8 – Alternative Bay Trail Route

This alternative included a Bay Trail along the San Pablo Bay and Novato Creek outboard levees. It required pedestrian bridges over breaches in the levee and would have necessitated maintenance of levee integrity.

This alternative was dismissed from further consideration for the following reasons: it is inconsistent with the proposed Bay Trail route; it is inconsistent with the adopted HWRP; it would prevent lowering of the outboard levees to allow integration of the restored tidal wetlands with Novato Creek and San Pablo Bay; it would likely result in public access conflicts with threatened and endangered species and their habitats; it is inconsistent with current City of Novato planning for the Bay Trail; and it would generate long-term management costs.

## Alternative Feature 9 – Alternative Novato Sanitary District Wastewater Alignments

Possible alternative locations for the new Novato Sanitary District (NSD) pipeline alignment included: routing the pipeline along the central crossing levee and the BMKV/Novato Creek levee, and routing the pipeline along 1 of the drainage divides between the tidal cells. The alternative routings would have permitted lowering the BMKV/HAAF berm to allow integration of the tidal marsh restoration areas over time. Either routing would require ongoing

1 maintenance of an access road and construction of a new outfall to San Pablo  
2 Bay.

3 The alignment along the northern side of the BMKV site was dismissed from  
4 further consideration for the following reasons: except for a potential breach  
5 location, a berm for an access road along Novato Creek would remain in place,  
6 preventing the integration of the restored tidal wetland with Novato Creek;  
7 installation of the new pipeline would require disturbance to the outboard marsh;  
8 and location of the outfall near the mouth of Novato Creek could affect water  
9 quality in the creek.

10 The alignment along the drainage divide between the new northern tidal cell and  
11 the adjacent cell was dismissed from further consideration for the following  
12 reasons: this alignment would require construction of a berm for an access road  
13 along the drainage divide, which would segregate the northern tidal cell from the  
14 rest of the site; additional construction would be necessary for the new berm; and  
15 the new outfall would be located closer to the mouth of Novato Creek and could  
16 affect water quality in the creek.

17 Although constructing the new pipeline along the existing alignment would  
18 require ongoing maintenance of most of the BMKV/HAAF berm to ensure  
19 continuing access for maintenance of the NSD line, the HAAF and BMKV sites  
20 are believed to encompass sufficient tidal marsh acreage to buffer the segregation  
21 effects of the NSD line. In addition, the existing outfall location is as far as  
22 possible from the mouth of Novato Creek. If future changes in wastewater  
23 routing or treatment technology eliminate the need for this outfall, it might be  
24 possible to lower the berm/access road to promote better integration of the sites.

## 25 **Alternative Feature 10 – In-Kind Replacement of** 26 **Agricultural Wetlands**

27 One of the identified HWRP goals stipulates that the project shall incur “no net  
28 loss of wetland habitat presently provided at the BMKV and HAAF sites” (see  
29 chapter 1). The preliminary design phase examined several alternative means of  
30 achieving this goal.

31 The 1997 LSA wetland delineation, which was certified by the Corps, identified  
32 155 acres of nonagricultural jurisdictional wetlands and 151 acres of agricultural  
33 jurisdictional wetlands. The 151 acres of agricultural wetlands identified in the  
34 delineation represent a statistically derived estimate of average ponding acreage  
35 within the cultivated fields. Flooded fields provide foraging and resting habitat  
36 for a wide diversity of wintering and migrant shorebirds, waterfowl, and other  
37 water birds during winter.

38 Analysis of “no net loss of wetland habitat” for wetland restoration projects in  
39 diked former baylands that are used for agriculture poses unique questions for  
40 project sponsors. Acreage is the measure historically used in discussions of

compensatory mitigation related to the Corps' national "no net loss" policy, primarily because it has been difficult to identify a single standard for all of the functional components considered during the physical and ecological evaluation required for decision making. "No net loss" is most broadly interpreted as requiring replacement of any lost wetland acreage at a ratio of at least 1:1, but while no net loss remains Corps policy, as described in the October 31, 2001 Regulatory Guidance Letter, more focus is now being placed on ecosystem approaches to the resource needs of adjacent and surrounding watersheds in developing appropriate mitigation (U.S. Army Corps of Engineers 2001a).

Exact in-kind replacement of the 151 acres of agricultural wetlands would require retention of at least 151 acres in agriculture and creation of appropriate surface topography to allow those 151 acres to pond every year. Retention of agriculture would require maintenance of these areas, which does not meet the HWRP objective of minimizing active management. Preservation of agricultural activity on the site is not among the goals of the HWRP and would likely result in conflict between agricultural use and the protection and enhancement of resources, and was thus dismissed from further consideration.

In-kind replacement of the 151 acres of agricultural wetlands by creating/restoring seasonal wetlands is feasible at the site. However, any additional seasonal wetland acreage at the site would be created/restored at the expense of acreage that could be devoted to restoring tidal marsh for the benefit of tidal marsh-dependent species, including special-status species. Moreover, ponded agricultural habitat is not considered a limiting factor for wildlife along the northern rim of San Pablo Bay.

## Alternative Feature 11 – Extend Tidal Reach to Pacheco Pond

An alternative eliminating the levee separating Pacheco Pond from BMKV and constructing no central crossing levee would be feasible if dredged material was placed as fill to raise the existing site grade on BMKV and at Pacheco Pond. Under this scenario, tidal flow would affect the entire pond, changing the existing brackish environment, and could extend farther upstream into Pacheco Creek and Arroyo San Jose. This alternative was dismissed from further consideration for the following reasons: it could create flooding problems on lands surrounding Pacheco Pond; existing brackish and freshwater environments would be lost; it would conflict with the existing MCFCWCD–DFG agreement about maintenance of brackish habitat in the pond; and it would not create a diverse array of habitats.

## **Alternative Feature 12 – Removal of Berm Separating BMKV and HAAF**

Complete removal of the berm separating BMKV and the HAAF site would allow integration of the restored tidal marsh and seasonal wetland environments. This alternative was dismissed from further consideration because of the need for the expansion to accommodate the existing NSD outfall pipeline and the potential replacement pipeline and permit periodic maintenance of the existing and future outfall. Breaching a portion of the berm was also considered to allow partial integration of the tidal marsh restoration areas, but was dismissed because of the difficulty to maintain NSD access and the need for maintenance of either temporary or permanent bridging structures.

## **Alternative Feature 13 – Alternative Breach Location on Novato Creek**

A breach could be located on Novato Creek near the existing BMK navigational lock. This alternative breach location was dismissed from further consideration because it would conflict with the provision of an upland buffer adjacent to the BMK residential area and lagoon, and would place tidal marsh habitat in close proximity to residential and recreational users.

## **Alternative Feature 14 – Reclaimed Wastewater Alternative**

Reclaimed wastewater from either the NSD or the Ignacio Sanitary District could be used to enhance freshwater flows to the expansion restoration site. This alternative was dismissed from further consideration for the following reasons: reuse of wastewater is not among the purposes of this expansion; using reclaimed wastewater in a wetland project adjacent to a residential area has the potential to raise water quality issues such as depressed dissolved oxygen content (depending on the quality of the reclaimed water); and flow augmentation would not be necessary to achieve the desired wetland habitats on the site. Other potential problems associated with this alternative include the potential for objectionable odors resulting from use of reclaimed wastewater.

## **Alternative Feature 15 – Single Large-Basin, Single- Breach Alternative**

This alternative would design the tidal portion of the site with only 1 basin and 1 breach to reduce the area of existing tidal marsh and mudflat that would be lost

due to the creation of new tidal channels. Depending on the size designed for tidal marsh, a single basin could be between 1,000 and 1,400 acres in size. Based on experience with other wetland restoration projects and an understanding of the hydrology of existing tidal marshes, there are concerns about whether a single breach would be capable of providing sufficient tidal flows to promote natural channel formation and to provide full tidal exchange to a basin of this size (Jones & Stokes 2002). A further concern is that use of a single breach/single basin would not allow a phasing approach that could allow cells to be completed and opened to tidal action in sequence. This alternative was dismissed from further consideration because of this potential failure to provide hydraulic and biological functionality on restored wetlands and the elimination of potential phasing of wetland restoration.

## **Alternative Feature 16 – Flood Control Alternative Feature 1**

This alternative feature was suggested by MCFCWCD for analysis. This alternative was described in the 1993 EIR prepared for the proposed residential development and golf course at BMKV. This alternative feature was proposed in the 1993 EIR as a means of reducing peak flood stage at Highway 37 to 7 feet NGVD to provide an equivalent to the “ultimate channel” described in the Marin County flood control ordinance (Environmental Science Associates 1993).

This alternative feature would route Novato Creek flood flows through the BMK south lagoon by taking water via culvert when stage on Novato Creek reaches 7 feet NGVD, and discharging it to a large detention basin on the BMKV parcel. The detention basin would be closed to tidal action and would be designed to drain at low tide. This feature would include construction of an additional culvert from Novato Creek to the BMK south lagoon at the location of the 3 western culverts between the creek and the lagoon, as well as construction of conveyance structures from BMK south lagoon to the detention basin, and the detention basin to San Pablo Bay.

Flood control (outside of mitigation, where significant adverse physical effects on flooding are identified) is not a purpose of the HWRP or the BMKV expansion. As described in chapter 4 of this document, the hydrologic and hydraulic analysis concluded that the 3 restoration alternatives selected for analysis in this document would not have an adverse physical effect on flooding, and that, even if it were determined that the project is inconsistent with the local flood zoning ordinance, this would not be a significant effect on the environment. A flood control feature is not necessary as mitigation because no significant physical adverse effect has been identified. Furthermore, maintenance of a large portion of the site as a detention basin would severely limit the amount of the site that could be restored to tidal wetlands or other habitats, which would not meet the goal and objectives of the project. Thus, after consideration, this alternative feature was dismissed from further analysis in this document.

## Alternative Feature 17 – Flood Control Alternative Feature 2

This alternative feature was also suggested by MCFCWCD for analysis and was also described in the 1993 EIR prepared for the proposed residential development and golf course at BMKV. This alternative feature was proposed in the 1993 EIR as a means of reducing peak flood stage at Highway 37 to 7 feet NGVD to provide an equivalent to the “ultimate channel” described in the Marin County flood control ordinance (Environmental Science Associates 1993).

This alternative feature would include widening Novato Creek from Highway 37 to San Pablo Bay, using a by-pass channel near Highway 37, and moving the existing north-side levees northward to expand the existing channel. In order to maintain the initial channel capacity in the by-pass channel and main channel, maintenance dredging would be required approximately every 10 years.

Flood control (outside of mitigation where significant adverse physical effects on flooding are identified) is not a purpose of the HWRP or the BMKV expansion. As described in chapter 4 of this document, the hydrologic and hydraulic analysis concluded that the 3 restoration alternatives selected for analysis in this document would not have a physical adverse effect on flooding, and that, even if it were determined that the project is inconsistent with the local flood zoning ordinance, this would not be a significant effect on the environment. A flood control feature is not necessary as mitigation because no significant physical adverse effect has been identified. This alternative feature would result in a significant change in the habitats within the lower portion of Novato Creek, which includes tidal salt marsh habitat that supports threatened and endangered species. Destruction or alteration of existing special-status species habitat in Novato Creek to build the bypass channel or to widen the existing channel is not necessary to conduct the restoration project and is counter to the goal of the project, which is to increase the amount of habitat for special-status species. In addition, NSD uses the fields north of Novato Creek as spray-irrigation fields for treated wastewater, and construction of new levees or a bypass channel could obstruct this use. Furthermore, these lands are not under the control or ownership of the project sponsors. Thus, after consideration, this alternative feature was dismissed from further analysis in this document.